INSTRUCTION MANUAL

ISSUE B

SEPT. 1975

SONA-GRAPH

6061-B

7029A

7030A

We urge customers to use caution when operating or repairing an instrument. Use instruction manual for correct operating procedures and repair. Pay close attention to the decals on Kay's equipment where voltage is located. This is for your safety.

Some people may experience mild allergic signs from sonagram fumes using the Sona-Graph. Use adequate ventalation.

KAY ELEMETRICS CORP. PINE BROOK, N.J. 201-227-2000

KAY ELEMETRICS CORP

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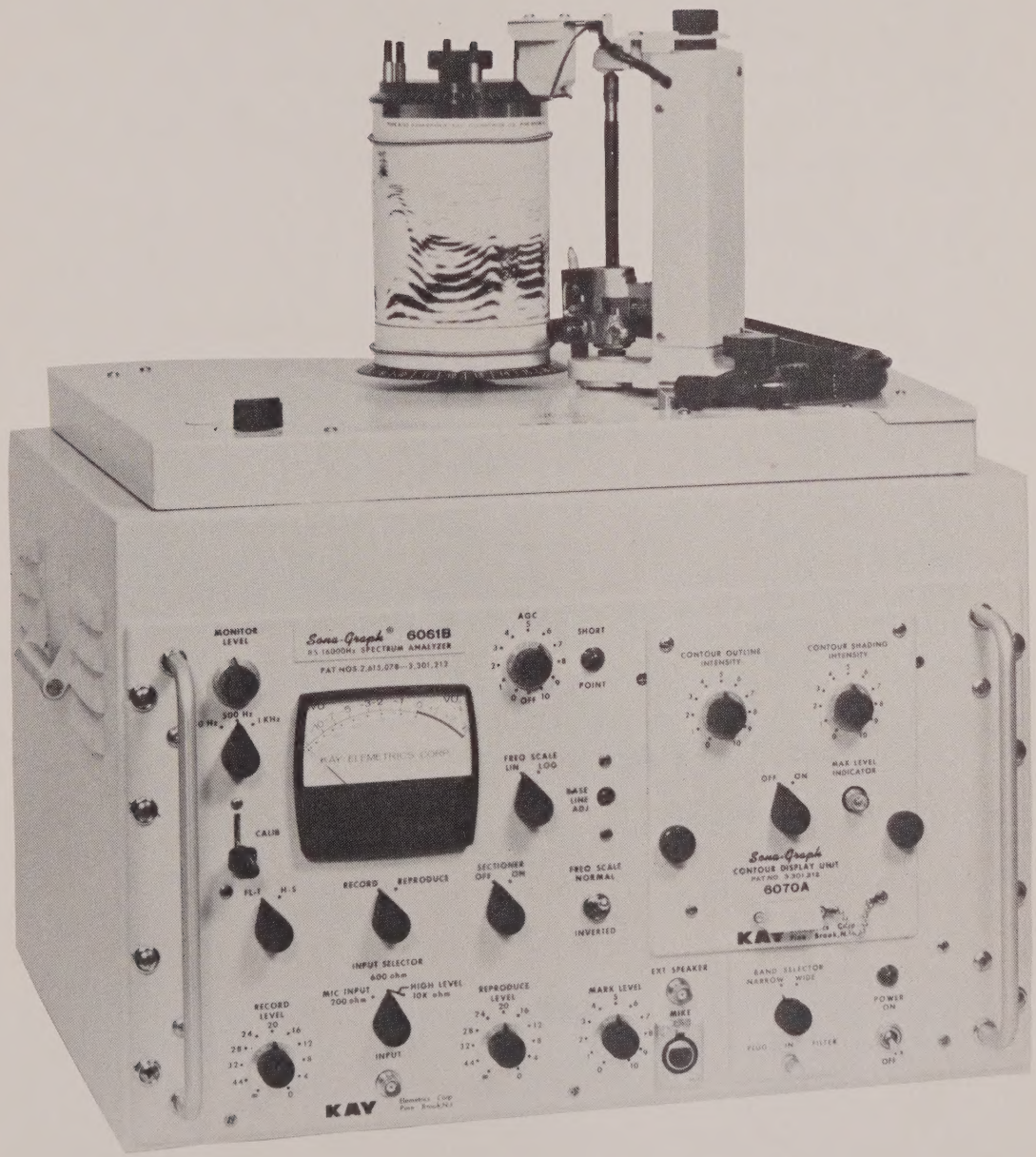
Sona-Graph 6061B
85-16000Hz SPECTRUM ANALYZER
PAT NOS 2,615,078—3,301,213
MONITOR LEVEL
AGC
SHORT
POINT
CONTOUR OUTLINE INTENSITY
CONTOUR SHADING INTENSITY
FREQ SCALE LIN LOG
BASE LINE ADJ
OFF ON
MAX LEVEL INDICATOR
CALIB
RECORD
REPRODUCE
SECTIONER OFF ON
FREQ SCALE NORMAL
INVERTED
Sona-Graph
CONTOUR DISPLAY UNIT
PAT NO 3,301,218
6070A
KAY
INPUT SELECTOR
600 ohm
MIC INPUT 200 ohm
HIGH LEVEL 10K ohm
INPUT
RECORD LEVEL
REPRODUCE LEVEL
MARK LEVEL
EXT SPEAKER
MIKE
BAND SELECTOR NARROW WIDE
PLUG IN FILTER
POWER ON
OFF
KAY

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Sona-Graph 7029-A

This section presents changes integral to the Operation and Specifications of the Sona-Graph 7029A. All references to the 6061-B should be changed to read 7029-A throughout this text.

The essential difference between the 6061-B and the 7029-A is in the number of record frequency ranges. The 7029-A with its selection of low frequency record ranges, gives a more detailed analysis of low frequency information than does the 6061-B. The operation of the two units is identical except that when analysing low frequency information with the 7029-A, the appropriate record frequency range should be used. The record frequency range selecting switch (FREQ. RANGE Hz) is located on top of the mechanical unit and adjacent to the RECORD-OFF-REPRODUCE switch.

SPECIFICATIONS

Frequency Range:	5 to 16,000 Hz in six ranges
Displays Available:	Frequency-vs-amplitude-vs-time (conventional) Frequency-vs-amplitude-vs-time (contour) Amplitude-vs-frequency Amplitude-vs-time
Analysis Time:	1.3 Minutes
Effective Resolution:	5-500Hz 2.8 & 19.0 Hz 10-1000Hz 5.6 & 37.5 Hz 20-2000Hz 11.2 & 75 Hz 40-4000Hz 22.5 & 150 Hz 80-8000Hz 45 & 300 Hz 160-16000Hz 90 & 600 Hz
AGC Range:	Compresses 20 to 40 dB variations into 10 dB plus OFF position
Frequency Calibration:	Switchable at 50, 500 or 100 Hz intervals
Response:	Plus or minus 2 dB over the entire range
Recording Time:	5-500Hz 38.4 sec. 10-1000Hz 19.2 sec. 20-2000Hz 9.6 sec. 40-4000Hz 4.8 sec. 80-8000Hz 2.4 sec. 160-16000Hz 1.2 sec.
Amplifier Characteristics:	Flat or 13 dB high-frequency pre-emphasis
Input Impedance:	200, 600 or 10,000 Ohms, switchable
Recording Medium:	Nickel-cobalt plated turntable
Microphone Supplied:	Turner, Model 2302
Power Supply:	117V, 50/60 Hz, 100 watts
Dimensions:	25"H x 20"W x 18 1/2"D
Weight:	125 lbs. approx.

VIBRALYZER 7030-A

The Operators Manual for the 6061-B may be used when operating the Vibralyzer 7030-A with the following changes:

A. SECTION I

SPECIFICATIONS

FREQUENCY RANGE: 1 Hz to 16 KHz

RECORD TIME:

Range (Hz)	Record Time (sec.)	Resolutions (Hz)
1-100	192.5	.56 & 3.8
4-400	48.1	2.2 & 15.2
5-500	38.4	2.8 & 19.0
10-1000	19.2	5.6 & 37.5
20-2000	9.6	11.2 & 75
40-4000	4.8	22.5 & 300
80-8000	2.4	45 & 300
160-16000	1.2	90 & 600

FREQUENCY CALIBRATION: 50, 500 or 1000 Hz, Switchable

DISPLAYS AVAILABLE: Frequency-Amplitude-Time (conventional)
Frequency-Amplitude-Time (contour)
Amplitude-vs-Frequency
Amplitude-vs-Time

RESPONSE: $\pm$2 dB over entire range

AGC RANGE: Compresses 20 to 40 dB variations into 10 dB plus OFF position

AMPLIFIER CHARACTERISTICS: Flat or 13 dB high shape

INPUT IMPEDANCE: 200, 600, or 10,000 ohms, switchable

ANALYSIS TIME: 1.3 Min.

RECORDING MEDIUM: Nickel-cobalt plated turntable

MICROPHONE PROVIDED: Turner Model 2302

POWER SUPPLY: 117V, 50/60 Hz, 100 W, Regulated

The RECORD-OFF-REPRODUCE switch should be in the position corresponding to the frequency of the signal being analyzed. (The FREQUENCY RANGE switch should be in the same range.)

All remaining procedures will be the same as for the 6061-B.

The 6061-B Maintenance Manual may be used for alignment, trouble-shooting, etc., of the 7030-A.

Reference should be made in all cases to the additional analyzing band. These are to be included in the alignment procedures, etc. where applicable.

SECTION 1

SPECIFICATIONS

Introduction

The Sona-Graph 6061-B is an audio-frequency spectrum analyzer that produces permanent graphic recordings of any type of complex wave in the range of 85 to 16,000 Hz. Unlike conventional spectrum analyzers, the 6061-B permits four different analysis to be displayed; the operator can select the display that most accurately shows the parameters he is studying. The #1 display gives an overall, three-dimensional picture of the signal being analyzed; frequency, amplitude and time are presented simultaneously on one display. This pattern (a Sonagram) can be seen in Figure 1-1.

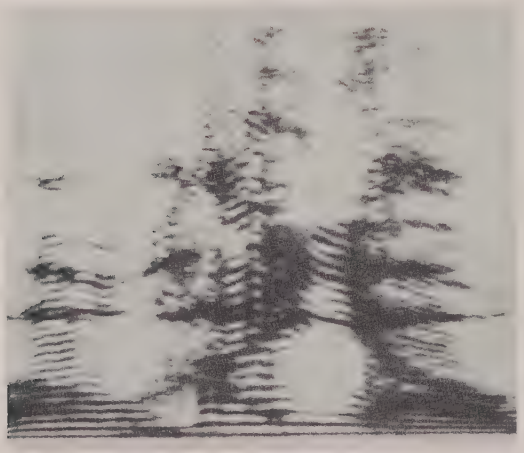


Figure 1-1

The second type of analysis, a #2 display, permits the individual amplitude of each frequency component to be displayed at any preselected point in time. This type of pattern is referred to as a Section, and can be seen in Figure 1-2.

Figure 1-2

The third analysis that can be performed is similar to an oscilloscope display; it shows the average amplitude of all frequencies present, relative to time. With this pattern, the entire input signal can be examined for flatness resonance peaks or any amplitude study relative to time. For an example of this display, see Figure 1-3. This pattern is made with the use of the Scale Magnifier/Amplitude Display plug-in Model 6076-C and will be referred to as a #3 display.

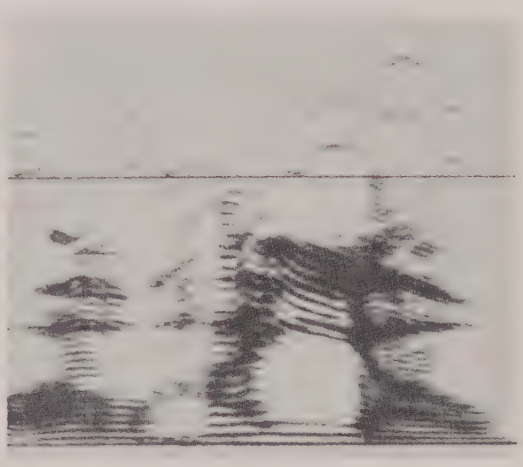


Figure 1-3

The last type of pattern is similar to the #1 display, but the amplitude is displayed as contour levels of 6 db. This pattern is made by the use of the Contour Display (Model 6070-A) plug-in. An example of the contour pattern is shown in Figure 1-4.

Figure 1-4

This unit will display any portion of audio in the 85 to 16,000 Hz. range. The input signal is first recorded on a continuous tape, and then played back at a high speed during the analysis process. A frequency-heterodyne technique is used for the scanning system and there are two plug-in filters available for increased flexibility. The narrow filter emphasizes frequency resolution, and the wide filter emphasizes time resolution (Figures 1-5 and 1-6, respectively).

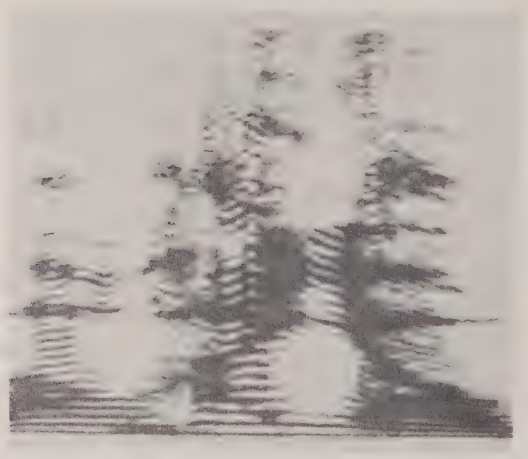


Figure 1-5

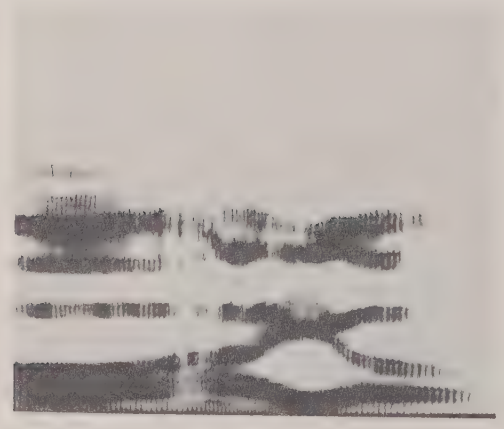


Figure 1-6

A built-in calibration tone generator can provide frequency markers every 50, 500 and 1,000 Hz. along the frequency scale of the pattern simply by depressing a switch. For an illustration of the frequency calibrator see Figure 1-7.

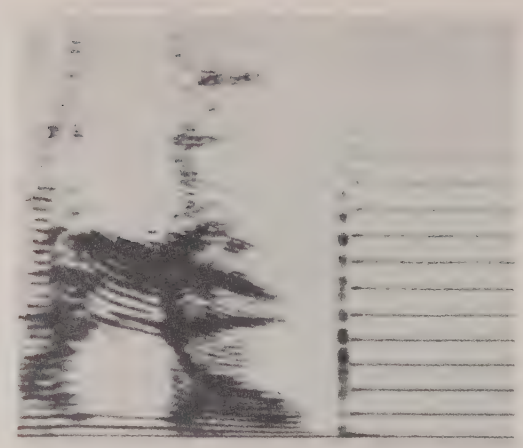


Figure 1-7

An adjustable AGC control is present, and can be used to extend the dynamic range of the pattern (Figure 1-8); also the darkness of the pattern can be adjusted to obtain the best contrast.

Figure 1-8

For monitoring purposes, a VU meter and a speaker can be used simultaneously either when recording the input signal or when performing the analysis.

INSTALLATION

Unpacking: After removal of packing cases and protective paper wrapping, the equipment should be visually checked for physical damage. Then check the packing case to insure removal of all items shipped. Any shortage or damage should be reported to the carrier and Kay Elemetrics Corp.

To prevent damage during shipment, the turntable, the small drum, and the RECORD-REPRODUCE and ERASE heads are locked in place. To ready the unit for operation:

(a) Loosen the knurled-head locking screw located at the base of the stylus housing next to the stylus lead screw. See that the screw is not in contact with the turntable.
(b) Remove the large knurled nut located on the top of the drum. Remove the small knurled nut from the top of the stylus housing, noting its position. Remove the retainer plate and felt pads. Place the spring on the shaft that holds the small knurled nut. Reverse the position of the knurled nut and after ascertaining that it is properly seated on the spring, tighten it securely.
(c) Remove the six magnetic pins from their plastic shipping container (six additional pins are provided for use with the large drum) and insert them in the storage holes near the center of the micrometer plate.
(d) Remove the screw from the cover plate over the RECORD-REPRODUCE head. Carefully remove packing material from the heads, and replace the cover plate.

Operating Notes: The Sona-Graph is completely self-contained; merely connect the line cord to a source of 117 volts AC, connect the microphone, fasten a sheet of Sonagram paper to the drum and you are ready to begin operation. As in the case of any general purpose laboratory instrument, the 6061-B should be kept free of excessive vibration, humidity, and temperature variation.

(NOTE: Both the 6076-C and Dummy Plug-In units have AC interlocks, either unit must be installed before operation).

Installation of the Large Drum: Remove the screws securing the mechanical unit covers, remove the RECORD-OFF-REPRODUCE knob (note the position of this control before removing), and lift off the covers. Loosen the sectioner plate lock nut and swing back the sectioner plate. Remove the drum lock, micrometer plate and small drum. When lifting the small plate, avoid raising the turntable since this may damage the heads. Loosen the stylus housing lock screw and slide the housing forward slightly, now remove the drive belt.

Install the Large Drum drive belt and slide the stylus housing all the way back; retighten the stylus housing lock screw. Slowly lower the Large Drum down the shaft until seated. Place the large micrometer plate in position and replace the drum lock nut.

Now swing the sectioner plate block to its original position and lock in place. Loosen the screw securing the reed switch block and pointer and slide the assembly to the extreme position away from the stylus housing. The reed switch tip should be set within 1/16 inch of a magnetic pin placed in one of the holes around the top of the drum. Tighten down the front holding screw.

Now replace the mechanical unit covers and control knobs.

The Large Drum comes equipped with 12 magnetic pins. Two pins are installed in adjacent holes at each position. Set the stylus wire to the exact point that you want to section; then, install a pin in the hole indicated by the pointer and one in the next hole clockwise. If you should reinstall the small drum, swing the pointer back to its closest position.

Removal of 6076-C and Dummy Plug-in units:
(a) Loosen the pawl fasteners, located on either side of the plug-in front panel, by turning the fastener knobs in a counterclockwise direction. (2 or 3 turns should free each lock).
(b) Grasp both knobs simultaneously and slide the plug-in out of the cavity. When replacing the plug-in, use the reverse of the above procedure. Do not attempt to secure the plug-in until it is properly seated in the cavity, (i.e.—Flush with the front panel of the 6061-B).

Removal of the Plug-in Filter:
(a) Loosen the pawl fasteners, located beneath the BAND SELECTOR switch, by turning the fastener counterclockwise.
(b) Slide the filter out of its cavity. Reverse procedure to replace filter.

SPECIFICATIONS

FREQUENCY RANGE:	85 to 16,000 Hz. in two ranges.
DISPLAYS AVAILABLE:	Frequency-vs-amplitude-vs-time (conventional) Frequency-vs-amplitude-vs-time (contour) Amplitude-vs-frequency Amplitude-vs-time
ANALYSIS TIME:	1.3 Minutes
EFFECTIVE RESOLUTION:	85-8000 Hz. 45 & 300 Hz. 160-16000 Hz. 90 & 600 Hz.
AGC RANGE:	Variable 20 to 40 db or OFF with 10 db
FREQUENCY CALIBRATION:	Switchable at 50, 500 or 1000 Hz. intervals
RESPONSE:	Plus or minus 2db over the entire range
RECORDING TIME:	85-8000 Hz. 2.4 Seconds 160-16000 Hz. 1.2 Seconds
AMPLIFIER CHARACTERISTICS:	Flat or 13 db high-frequency pre-emphasis
INPUT IMPEDANCE:	200, 600 or 10,000 Ohms, switchable
RECORDING MEDIUM:	Nickle-cobalt plated turntable
MICROPHONE SUPPLIED:	Altec-Lansing 681A dynamic
POWER SUPPLY:	117 V, 50/60 Hz, 100 watts
DIMENSIONS:	25" H x 20" W x 18½" D
WEIGHT:	125 lbs. approx.

OPERATION

SECTION II

OPERATING INSTRUCTIONS

DESCRIPTION

The Sona-Graph 6061-B is a completely solid-state sound spectrograph with all its necessary systems enclosed in one cabinet. This instrument consists of three basic systems; the drive mechanism for the turntable and drum, the electronic circuitry of the amplifier-analyzer, and the regulated power supply. In order to have a compact unit, and at the same time provide accessibility to all circuits, plug-in type component boards have been used wherever practical.

2.1 OPERATING CONTROLS AND FEATURES

CONTROL	POSITION	FUNCTION
POWER Switch (S-13)	ON	Line voltage is applied to power supply. Pilot light is on.
	OFF	Electrical circuitry is completely denergized.
INPUT SELECTOR switch (S-3)	MIC INPUT	Provides a 200 ohm matching impedance for microphone.
	HIGH LEVEL	Provides a separate 600 and 10K ohm input impedances.
RECORD-REPRODUCE switch (S-5)	-------	Selects mode of operation of amplifier-analyzer system.
RECORD LEVEL control (R-4)	Stepped Variable	Provides an adjustment of the record amplifier gain in 2 DB increments.
REPRODUCE LEVEL control (S-5)	Stepped Variable	Provides an adjustment of the reproduce amplifier gain in 2 DB increments.
FL-1-HS switch	FL-1	Provides an overall response, flat within ±2DB.
	HS	Provides a high-frequency pre-emphasis in the record circuits.
MONITOR LEVEL control (R-1)	Variable	Controls the audio output at the speaker.
CALIB ON SWITCH	Momentarily Depressed	Provides calibration marks at selected intervals on the frequency scale of Sonagram.
CALIB FREQ SELECT (S-12)	Switchable	Allows the selection of 50,500,1000 Hz, calibration lines.

CONTROL	POSITION	FUNCTION
BAND SELECTOR switch S-1001)	NARROW	Provides selection of narrow bandwidths.
	WIDE	Provides selection of wide bandwidths.
SECTIONER switch (S-9)	OFF	Enables a #1 display to be produced on the Sonagram.
	ON	Energizes the Sectioner circuits to provide a #2 display. Disable AGC circuits.
FREQ SCALE switch (S-8)	INVERT	Provides a means of inverting the frequency presentation.
AGC switch (See note below)	------	Concentrically part of the AGC control, this switch permits the AGC to be turned off.
AGC control (R-2) (See note below)	Variable	Compresses the maximum recorded signal to 10 DB, the limit of the Sonagram paper.
BASELINE ADJust control (R-3)	Variable	Enables the position of the baseline to be adjusted on the Sonagram.
MARK LEVEL control (R-6)	Variable	Controls the darkness of the Sonagram.
FREQ SCALE LIN-LOG switch (S-7)	------	Enables the frequency scale to have a linear or logarithmic presentation.
VU meter (M-1)	------	Provides visible means of monitoring the record.
SHORT POINT indicator	------	This lamp glows when the stylus control is at the bottom and the top of the Sonagram; at this point the Marking amplifier circuitry is disabled and no mark will appear on the Sonagram.
TAPE RECORD input	JONES PLUG	Provides a means of feeding data from a tape recorder into the 6061-B analyzing circuits.

NOTE: The following table will serve to illustrate the operation of the AGC switch and control:

CONTROL POSITION	DISPLAYED AMPLITUDE RANGE
OFF	10 to 12 db
0	20 db
5	30 db
10	40 db

TERMINAL	FUNCTION
MIKE INPUT	This is the input to the record amplifier circuitry.
EXT SPEAKER	Provides an output for a remote speaker.
INPUT connector	This is the input to the record amplifier circuitry.

2.2 MECHANICAL UNIT

This section describes the controls and features of the mechanical portion of the 6061-B. Most of these items are visible on the top of the Sona-Graph. Some of the more important features are explained below. Items that are not visible on the top of the unit are marked with an (*).

FEATURES	DESCRIPTION
RECORD-OFF-REPROD	Controls the application of power to the three speed drive system and blower motors, and activates the control circuits for the recorder. When set to either RECORD, position the turntable rotates at selected speed; when set to REPROD, the rotation is 300 rpm, and when set to OFF, all movement ceases.
Stylus Control Lever	Engages the Stylus Assembly with the lead screw and stylus wire with the paper.
Micrometer Plate	This plate can be used to divide the time of the recorded chart into 300 units (for Sectioning purposes). It provides four intermediate settings between each pin hole.
Neon Baseline Indicator	This lamp glows when the stylus is at the baseline frequency, and acts as an amplitude monitor of the modulated signal as the stylus moves up to the lead screw.
Stylus Adjust Screw	If the stylus wire becomes worn, this screw can be used to adjust the length and pressure of the wire on the Sonagram paper. Since there is a HIGH VOLTAGE on this adjusting screw, TURN OFF the 6061-B before attempting adjustment.
Blower Motor*	This is used to remove the smoke caused by burning of the Sonagram paper.

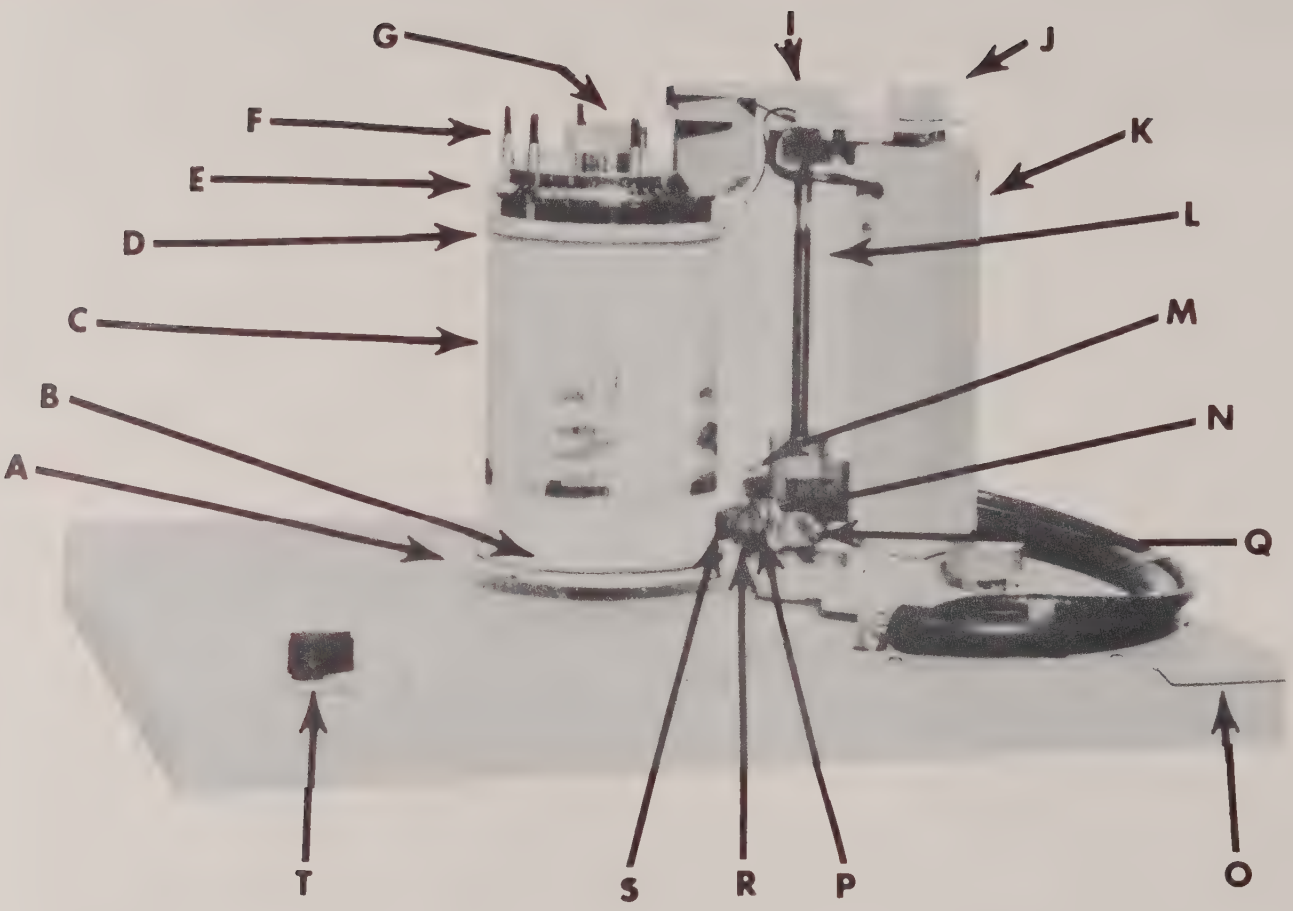


FIG. 2-1 DRUM AND STYLUS ASSEMBLY

A - INDEX PLATE

B - PAPER-HOLDING SPRING

C - SMALL DRUM (WITH SONAGRAM)

D - PAPER-HOLDING SPRING

E - MICROMETER PLATE

F - SECTIONER PIN

G - DRUM LOCK-NUT

H - REED SWITCH ASSEMBLY

I - SECTIONER PLATE

J - SECTIONER PLATE LOCK-NUT

K - STYLUS HOUSING

L - LEAD SCREW

M - NEON BASELINE INDICATOR

N - STYLUS ASSEMBLY

O - CORNER COVER PLATE

P - STYLUS ASSEMBLY

Q - STYLUS CONTROL LEVER

R - STYLUS ADJUST SCREW

S - STYLUS

T - REC-OFF-REP SWITCH

PRELIMINARY:

(a) Set the Sonagraph power switch to the OFF position. RECORD-OFF-REPRO to OFF.

(b) Insert the power cord in the receptacle at the rear of the unit and turn it clockwise. Plug the other end of the line cord into a 117 volt, 50/60 Hz source.

(c) Pull the stylus control lever away from the drum and lower it to the bottom of the stylus lead screw.

(d) Insert a magnetic pin in one of the sectioner holes (around the top of the drum). Slowly turn the drum by hand and see that there is a clearance of within 1/16 of an inch between the pin and the reed switch at the top of the stylus housing.

(e) Now, set these controls as shown:

1. SECTIONER switch - OFF
2. MARK LEVEL control - 0
3. REC-REP switch - REPRODUCE

(f) Turn the power switch to ON, and allow the unit a few minutes warm-up time to stabilize the circuits.

(g) NOTE: Allow the turntable to come to a complete halt before changing from Record speed to another or from the Reproduce speed to a Record speed.

2.3 RECORDING THE SIGNAL

A. Set the INPUT SELECTOR to the position best suited to the output impedance of your signal source.

B. Plug the output of your signal source into the INPUT jack.

C. Set the FL-1-HS switch to desired position. (The HS position is generally used for analyzing voice patterns.)

D. Set the RECORD LEVEL control to approximately 44.

E. Place the REC-OFF-REP in the RECORD position.

F. Turn up the RECORD LEVEL control until you get a 0-VU average reading of +3 VU on signal peaks. (For convenience, the level controls are calibrated in 2 db steps.)

G. Turn the RECORD REPRODUCE switch to RECORD.

H. Turn the REC-REP switch to REP immediately after this interval is complete. If you do not switch to REP by the end of one revolution, the signal recorded will be erased.

I. The recorded signal will now be reproduced repetitively and may be monitored by advancing the MONITOR GAIN control until a convenient volume is obtained.

2.4 INSERTING FREQUENCY MARKERS

The calibration tone is selectable; it will produce harmonics every 50, 500, or 1000 Hz. You can record this tone either when you initially record the input signal or after you have switched to the Reproduce mode.

A. If you are recording the input signal and you want to provide calibration, merely depress the CALIB switch momentarily, and the frequency markers will be recorded along with the signal.

b. If you have already recorded a signal and you wish to calibrate, listen to the signal being played back. Then depress the CALIB switch momentarily between the end and beginning of the recording; if you press the CALIB switch during the recorded material, erasure of this material will occur.

C. Please note that when you depress the CALIB switch, you energize the record circuits of the Sona-Graph. Therefore, if there is a signal at the INPUT jack, it will be recorded along with the calibrate tone.

2.5 SETTING THE BASELINE

A. Place the REC-OFF-REP in OFF position and lift the stylus holder to the point at which the SHORT POINT light just goes out. Partially engage the stylus but avoid letting the wire touch the drum.

B. Turn the AGC control to zero (minimum AGC).

C. Place the BAND SELECTOR switch in the NARROW position, and set the MARK LEVEL control at about (4).

D. Select either a LINear or LOGarithmic display, using the FREQ SCALE switch, and place the INVERTED-NORMAL switch in the NORMAL position.

E. Set the Selector switch (on 6076-C or 6070-A plug-in unit) in OFF position.

F. Rotate the BASELINE ADJUST control until the BASELINE INDICATOR lights. This adjustment insures the position of the baseline at the bottom of the pattern.

G. Return the stylus holder to the bottom of the lead screw.

2.6 FASTENING SONAGRAM PAPER

A. Adjust the MONITOR GAIN control for a convenient volume level, while manually rotating the drum.

B. Rotate the drum until a switch click is heard; this indicates the end of the recorded signal.

C. Look at the index plate at the bottom of the drum, and note the number which is opposite the stylus wire.

D. Push both of the springs down so they rest on the bottom flange of the drum.

E. Place a fresh piece of Sonagram paper around the drum with the coated side facing outward. Bring the edges forward and place the edge held in your left hand OVER the edge held in your right hand.

CAUTION: Placing the paper on the drum in the wrong direction will cause the stylus to pick up and tear the paper. It also may cause the stylus to be damaged.

F. While holding the paper firmly around the drum, push it down until it stops against the bottom flange. Then raise the top spring to secure the upper edge of the paper.

G. Rotate the paper on the drum until the overlap is directly over the index number noted in Step C.

2.7 PRODUCING THE SONAGRAM (# 1 DISPLAY)

A. Using the AGC control, select the desired amount of agc action. A minimum setting of the

control permits signals approximately -20db down from the reference level to be displayed on the pattern. A maximum setting of this control will enable levels down to -40db to be displayed.

B. Set the MARK LEVEL control for the desired pattern contrast. For a minimum agc setting, mark level of (2.5) should be sufficient; a level of about (7.5) should provide proper contrast for maximum agc settings.

C. Set the REC-OFF-REP to the REPRODUCE position.

D. Adjust the REPRODUCE LEVEL control for a reading of -3 on the VU METER.

E. The BAND SELECTOR switch may be set to either the NARROW or WIDE position.

F. Lift the stylus slightly and engage it with the lead screw making sure the stylus wire is touching the paper. (Avoid leaving the stylus close to the paper with the MARK LEVEL at a high value. Arcing could occur, causing damage.)

G. Allow the Stylus to travel up the paper until the upper SHORT POINT indicator lights.

H. Disengage the stylus and return it to the bottom of the lead screw.

2.8 TAKING A SECTION (#2 DISPLAY)

A SECTION gives an amplitude-vs-frequency display at a preselected point in time. The SECTIONER MICROMETER PLATE is divided into 300 units, eight milliseconds apart; a section may be taken at any one of these points.

A. Make a #1 display as described previously. Do not remove the completed Sonagram from the drum. Determine the point or points where you wish to see the sections. (A maximum of (6) sections may be made at one time, since each section requires a 2" segment of the Sonagram paper.)

B. With the stylus at the bottom of its travel, manually rotate the drum and turntable assembly until the tip of the stylus wire is exactly in line with the point to be sectioned.

C. Loosen the knurled knob holding the micrometer plate.

D. Insert a magnetic pin in the hole in the micrometer plate nearest to the pointer, and holding the drum and turntable in place, rotate the micrometer plate until the pin is exactly in line with the pointer.

E. Tighten the knurled knob.

F. Additional pins may be inserted, but the spacing between pins may not be less that (10) holes. The section will be taken at the point where the stylus rests on the paper when a pin passes the pointer.

G. For future reference, mark the Sonagram at the points where the Sections are to be taken. Also note the position of the overlap on the index. (The position of the Sonagram is important when aligning the paper for a #2 display).

H. Remove the Sonagram and replace it with a new sheet of paper; carefully position the overlap at the same index point as the previous sheet.

I. Turn the SECTIONER switch to ON, the MARK LEVEL control to (4), and the BAND SELECTOR switch to NARROW.

J. Place the mechanical SHIFT LEVER in the REPRODUCE position; lift the stylus control slightly and engage the paper. When the upper SHORT POINT indicator lights, the SECTION is complete. Disengage the stylus and return it to its rest position.

K. With the FREQ SCALE switch in the NORMAL position, the frequency presentation

of the SECTION will be inverted. (High frequencies will be at the bottom of the paper).

If the operator desires a Section at a different point in time, with reference to the original SECTION, he must readjust the MICROMETER PLATE or magnetic pin. Both the magnetic pin holes in the MICROMETER PLATE, and the graduation in the upper portion of the drum, are 40 milliseconds apart. In addition to the 60 pin holes, the MICROMETER PLATE also contains (5) graduations on its periphery which may subdivide any or all of the aforementioned holes, thus providing 300 possible divisions, 8 milliseconds apart. (300 x .008 sec. = 2.4 sec., recording time).

An example is now given to show how to set the MICROMETER. After a section run is made at a selected time (t=0).

1) Assume it is desired to sample a place 8 milliseconds earlier (t-8 milliseconds). Do this: Loosen knurled knob slightly and rotate the plate clockwise, in relation to the drum below, one micrometer division. This will cause the reed switch to be closed 8 milliseconds earlier than previous setting. Tighten the large knurled knob and take the Section.

2) If a sample is desired 24 milliseconds later *(i.e.,* t+24 milliseconds) perform this operation: Loosen the knurled knob slightly and rotate the plate counterclockwise, in relation to the drum below, three milliseconds divisions. This will cause the reed switch to close 24 milliseconds later than the referenced setting. Tighten the large knurled knob before taking a Section at this new point in time.

Do this for all settings up to t+32 milliseconds, and at t+40 milliseconds go to the next hole on the plate which is the same point.

L. Now the position of the recording paper on the drum. Remove completed sheet.

M. Place a new sheet of paper on the drum in the same position as the sheet just removed.

N. If Sonagrams and Sections are only to cover the range from 0 to 4 KHz or between 4 KHz and 8 KHz, both can be placed on one sheet of paper, with the Sonagram recorded on the lower half of the recording paper and the Section starting immediately above or vice versa. This can be done because the frequency scale is reversed when making a Section; consequently, the Section will start at 4 KHz directly above the Sonagram and end at zero frequency at the top of the recording paper.

PERFORMANCE CHECKS

2.9 APPLICATION

The information contained in this section can enable the operator of the 6061-B to perform a general, overall check of the unit. These check-outs can be applied whenever:

(a) The unit is initially received.
(b) The unit undergoes preventative maintenance.
(c) Any components, component boards, plug-in filter, or plug-in accessories have been replaced.

2.10 SECTIONER

A. Set controls as follows:

1. SECTIONER switch - ON
2. RECORD-REPRODUCE switch RECORD (selected speed)
3. REC-OFF-REP - RECORD
4. AGC control - Minimum (Not Off)
5. MARK LEVEL control - Approx. #2.5
6. BAND SELECTOR - NARROW
7. RECORD LEVEL control - approx. #20
8. FL-1-HS-switch - FL-1
9. INPUT SELECTOR - APPROPRIATE IMPEDANCE

B. Feed a 1 KHz signal into the INPUT jack, and adjust the RECORD LEVEL for a 0 VU meter reading; monitor the input with an AC VTVM.

C. Switch to REPRODUCE, and adjust the REPRODUCE LEVEL to obtain a -2 VU reading.

D. Place a fresh sheet of Sonagram paper on the DRUM.

E. Ascertain that the REED SWITCH contact is within 1/16″ of a MAGNETIC PIN.

F. Lift the stylus to a point where the 1 KHz signal will produce a mark on the paper.

(NOTE: Frequency range is inverted when making SECTION patterns).

G. Feed in other frequencies such as 1.5 KHz, 2 KHz, 2.5 KHz, 3 KHz etc. Decrease the input level 6 DB each time and mark the paper. (Different frequencies are used to prevent one pattern from obscuring another).

H. Do not change the RECORD or REPRODUCE LEVELS from the values of steps (2) and (3).

I. Each pattern will represent approximately a 6 DB change, and can be measured by using the scale -1/32″ = 1 DB.

2.11 OVERALL RESPONSE

A. Perform steps (A) through (f) as in Section 2.10

B. RECORD and REPRODUCE frequencies throughout the range of the 6061-B (Do not change the RECORD-REPRODUCE LEVELS set earlier).

C. Monitor the input amplitude to assure a flat response over the various frequencies.

D. Check the SECTION patterns for a flatness of +2 DB (1/32″ as equal to 1 DB).

2.12 AMPLITUDE DISPLAY (OPTIONAL)

A. Set controls as in Step A, Section 2.10 except for the Sectioner switch, which should be OFF.

B. Switch the 6076-C plug-in to AMPLITUDE DISPLAY.

C. Feed a 1 KHz signal to the INPUT jack, and adjust its amplitude to obtain a 0 VU meter reading.

D. Switch to REPRODUCE and place the REC-OFF-REP switch in REPRODUCE.

E. Lift the stylus to a point just below the upper SHORT POINT and adjust the REPRODUCE LEVEL control until the BASELINE INDICATOR lights; then engage the stylus and mark the paper.

F. Decrease the REPRODUCE LEVEL 6DB by rotating the control 3 "clocks" CCW - make a pattern.

G. Repeat the preceding step until a total of four patterns have been made.

H. Now, move the stylus to a point about one-third the way down the Sonagram paper and, while depressing the BASELINE switch, engage the stylus. Hold down the switch until the baseline has been marked on the paper.

I. The distance between each pattern will represent approximately 6 DB, for a total of 24 DB above the baseline. (Approx. 9/32 inch = 6 DB).

2.13 SYSTEM BANDWIDTH (Using the Scale Magnifier)

A. Set controls as in Step A, Section 2.12.

B. Feed a 1 KHz signal into the INPUT jack, and adjust its amplitude to obtain 0 VU meter reading.

C. Switch to REPRODUCE and adjust the REPRODUCE LEVEL to obtain -2 VU.

D. Lift the stylus to a point just below the upper SHORT POINT; then adjust the UPPER LIMIT control for a 1 KHz indication on the BASELINE INDICATOR.

E. Move the stylus to a point just above the lower SHORT POINT; then adjust the ZERO ADJ control for a baseline indication on the BASELINE INDICATOR.

F. Repeat, if necessary, the two preceding steps until both extremes are aligned.

G. Turn the SECTIONER switch to the ON position, and make a SECTION pattern showing the baseline and the 1 KHz signal.

(NOTE: The SECTION pattern will not have an inverted frequency scale when the SCALE MAGNIFIER is being used.)

H. Switch back to RECORD and feed a 500 HZ signal to the INPUT jack; adjust its amplitude to obtain a 0 VU meter reading.

I. Switch to REPRODUCE and adjust the REPRODUCE LEVEL for a -2 VU meter reading.

J. Make a section pattern of the 500 Hz signal.

K. The scale used to analyze this pattern is: 1/32" = 1 DB (Horizontal Direction) and 1/32" = 7.8 Hz (Vertical Direction).

L. To obtain the 3 DB points on the curve, measure 3/32's of an inch horizontally from the peak of the curve. Then draw a vertical line through this point. The two places at which this line crosses the 500 Hz curve are the 3 DB points.

M. Now, measure the distance between these two points; record this distance and calculate the bandwidth using the scale of Step K.

N. Switch the BAND SELECTOR to WIDE, and repeat this procedure.

OPERATING TIPS AND MAINTENANCE SUGGESTIONS

Reed switch contacts should be no more that 1/16 inch away from any magnetic pin or within ⅛ inch of any pin on units with serial numbers above 36032. Should the switch block be positioned more distant from the pins than noted above, the SECTIONER might fail to function or intermittent marking would be present.

Avoid leaving spare magnetic pin(s) in storage holes adjacent to the pin(s) in use. The magnetic properties of the spare pin might tend to disturb the magnetic field of the pin in use, thus causing the SECTIONER to function abnormally.

Although the calibration tone can be utilized during recording, insertion is easier in the REPRODUCE mode. After "capturing" the desired signal, adjust the MONITOR LEVEL to a convenient volume and, leaving the mechanical system in the record speed, depress the CALIB switch at the desired interval.

Utilize the BASELINE and SHORT POINT indicators in conjunction with the BASELINE ADJUST to facilitate baseline setting. With the mechanical system in neutral, raise the Stylus Control Lever until the SHORT POINT light just goes out; set the BASELINE ADJUST for maximum brilliance of the Baseline Indicator. This control should also be readjusted when switching the FREQ SCALE from LIN to LOG and vice-versa.

Cleanliness of the RECORD-REPRODUCE head, ERASE head and the TURNTABLE are essential for clear, accurate information contained on the Sonagram. Indications of dirty heads and/or turntable are: abnormal (faint) markings on the high frequency part of the pattern (use CALIBration tone for confirmation), and low readings on the Reproduce VU meter. Trouble may be remedied by cleaning both heads and turntable with a clean cloth dampened with polychlorethylene.

Cleanliness of the stylus assembly component parts and proper adjustment of the stylus is also necessary for clear sharp patterns. The stylus wire itself should be cut to protrude approx. ¼" from its housing. When engaged it should rest lightly on the paper with a slight angle to it. Improper stylus adjustment is indicated by abnormally light or dark, Sonagrams.

FIG 2-2 NORMAL CONTOUR DISPLAY
PATTERN

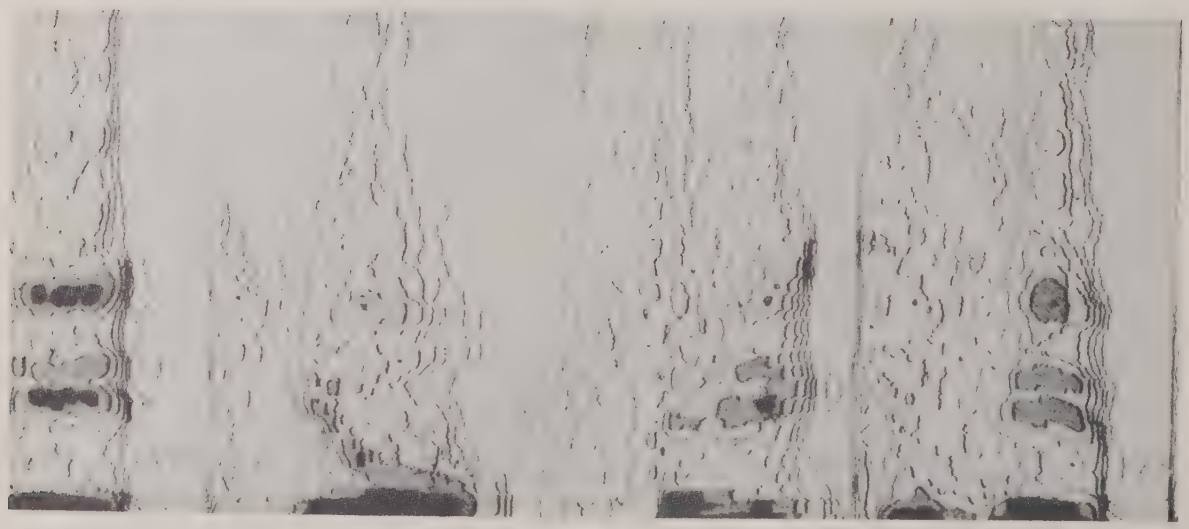


FIG. 2-3 CONTOUR DISPLAY PATTERN
INDICATING DIRTY HEADS
OR TURNTABLE

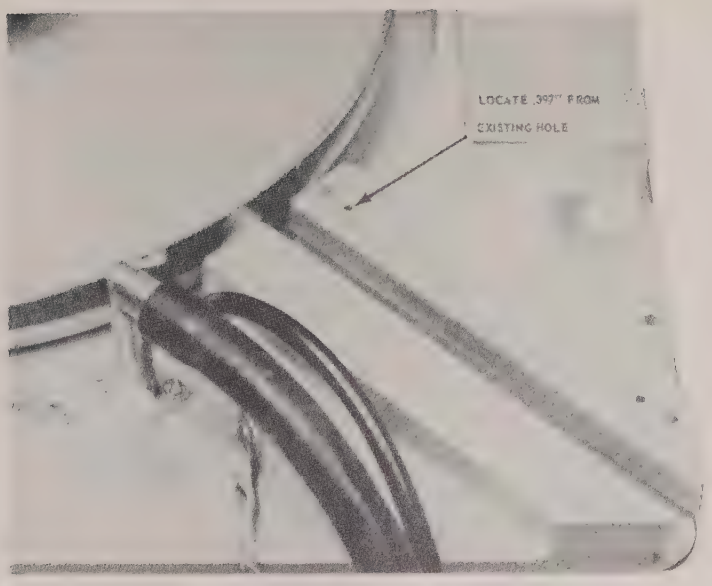


FIG. 2-4 INSTALLATION INSTRUCTIONS
FOR CAT. NO. 779 DRUM

To Install the Cat. No. 779 drum proceed as Follows:

1. Remove the knurled knob marked "LOCK" which secures the stylus assembly.

2. Remove the rubber drive belt.

3. Remove the stylus assembly from the unit. DO NOT UNSOLDER OR DISCONNECT THE WIRES OR RUBBER TUBING FROM THE ASSEMBLY.

4. Drill a .1240 ± .0005" diameter hole as indicated in Figure 1.

5. Tap the drive pin (taped to the 779 drum) into the hole leaving approximately ⅛" protruding.

6. Remove the old drum.

7. Install the 779 drum.

8. Replace the stylus assembly.

9. Adjust reed switch block if necessary so that tip of reed switch contact is within approximately 1/16" of the magnetic pins. See Figure 3.3 in maintenance section.

10. Turn MARK LEVEL control to zero. Remove stylus wire from stylus assembly.

11. Slide emery paper to bottom of drum, if it is not already there.

12. Run unit in REPRODUCE speed. Engage stylus so that it advances up the drum. Apply light pressure to hard rubber stylus wire shield so that it rubs against the emery paper and is abraded to contour of 779 drum. Repeat this operation if necessary.

13. Replace stylus wire and adjust.

OPERATION OF TAPE RECORDER WITH THE SONA-GRAPH

1. Connect plug (P-29) from tape recorder to TAPE RECORDER INPUT (J-29) on the analyzer electrical chassis.

2. Provide a connection between the tape recorder output and the Sona-Graph input.

3. Place the recorder speaker switch in the No. 2 position.

4. Ascertain that the recorder is plugged into an A.C. source and turn it on.

5. Place the Sona-Graph in the RECORD position.

6. Place the tape recorder in the "PLAY" position.

7. Use the Sona-Graph controls to record the desired portion of the tape.

8. Switch the Sona-Graph to the REPRODUCE position. (This should automatically stop the tape recorder, if not, place the TAPE RECORDER DISABLE switch to its other position.)

9. Sonagrams may now be produced in the normal fashion.

MAINTENANCE

INTRODUCTION

This manual presents information for the maintenance and alignment of the Sona-Graph 6061-B. The specifications and operation procedures can be found in the Operator's Section. For this discussion, reference may be made to the Functional Block Diagram, (Fig. 3-1), and to the Schematic Diagrams (Section 4 of manual).

CIRCUIT DESCRIPTION, OVERALL

Record Mode:

The signal to be analyzed is fed into the MICROPHONE INPUT jack, which is the input to the record amplifier. The amplified signal is then applied to both the record head and the monitoring circuitry. Since the erase head is biased, the tape is always clean before it passes by the record head. Therefore, a continuous process of record and erase is taking place. Depressing the calibrate pushbutton feeds a calibration tone into the record amplifier, along with the input signal. The monitoring system permits the recorded and reproduce signals to be observed on the VU meter and heard on the speaker.

Reproduce Mode:

The 6061-B has two record speeds as outlined in the Specification Table (see page 1-4). For the purpose of this discussion, only

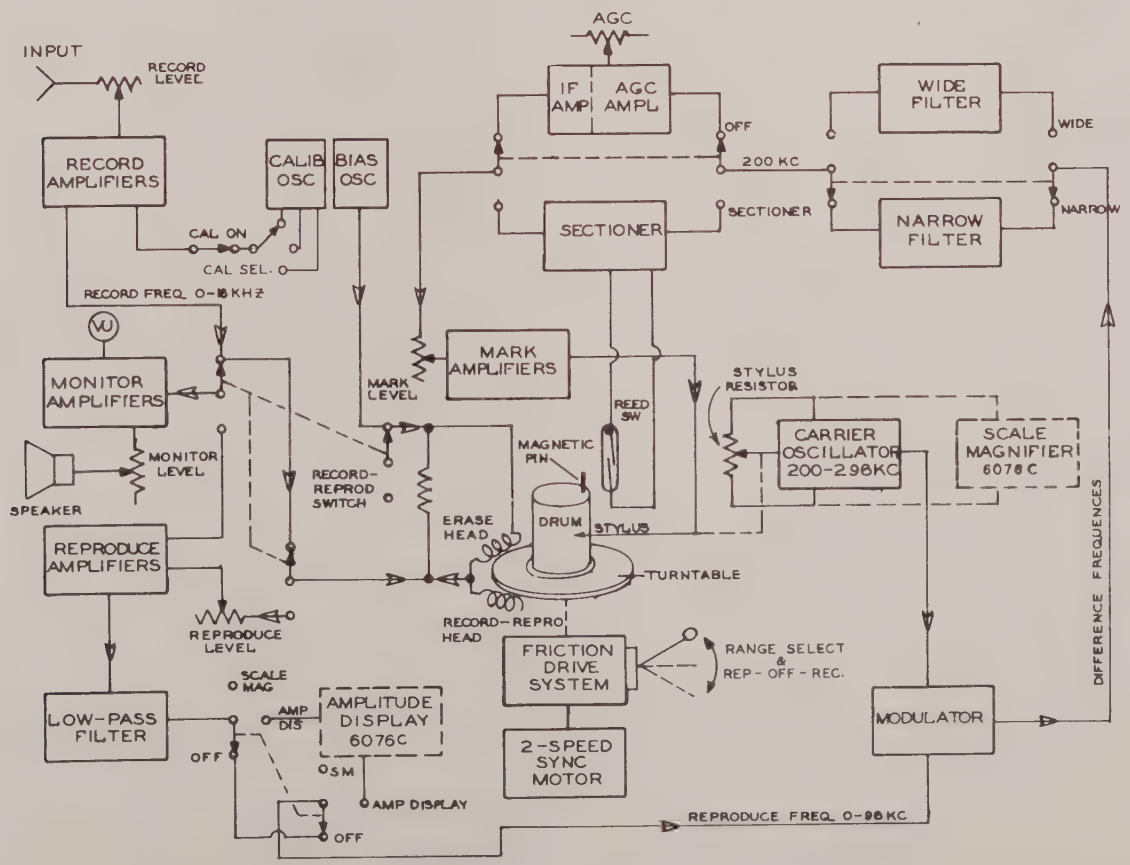


FIG. 3-1 FUNCTIONAL BLOCK DIAGRAM

the 8 KHz range will be described.

As soon as the Sona-Graph is switched to the REPRODUCE mode, the bias is removed from the erase head. This allows the last 2.4 seconds of recorded information to remain on the tape. The REC-OFF-REP switch on the mechanical portion of the 6061-B is placed in the REP position. The recorded signal is now played back continuously at a speed of 300 RPM, (12 times faster than the RECORD speed) to reduce the analysis time. As a result of this, a signal of 2KHz, for instance, would be reproduced as a frequency of 24 KHz. Now the signal is amplified by the reproduce amplifier and passes through a low-pass filter whose cutoff frequency is 96 KHz. This filter limits the range of the Sona-Graph to 8 KHz maximum, (96 KHz divided by 12). The output of the low-pass filter is fed to one input of a balanced modulator. The second input to the balanced modulator is obtained from the variable carrier oscillator whose frequency is controlled by the vertical position of the stylus assembly. When the stylus is at the bottom of its travel, the oscillator frequency is 200 KHz which coincides with the center frequency of the analyzing filters. This also corresponds to the low frequency end of the frequency scale. As the stylus moves up the paper, the frequency gradually increases to 296 KHz, which corresponds to 8 KHz on the frequency scale. The balanced modulator mixes the reproduced signal with the carrier oscillator and the resultant signal is fed to the NARROW-WIDE filters which have a center frequency of 200 KHz.

Suppose that a frequency of 5 KHz has been recorded on the turntable. When this signal is played back at the reproduce speed, this 5 KHz signal now becomes 5 KHz X 12=60 KHz. As the stylus slowly moves vertically, there won't be any output from the analyzing filters until the difference between the carrier oscillator and the input signal is 200 KHz. If 2 KHz and 5 KHz had been recorded simultaneously, then there would be output from the filters when the carrier oscillator reaches both 224 and 260 KHz.

The intensity of the signal marked on the Sonagram paper will be proportional to the original recording. The dynamic range of the Sonagram paper from black to white is 10-12 db. Greater dynamic ranges can be displayed by use of the A.G.C. circuit. This circuit will compress a 40 db signal change into a 10 db output change. When a section is being made, signals up to 35 db can be displayed, (eliminating the need for the AGC). A reed switch, activated by magnetic pins on the drum, enables the sectioner to sample the signal under examination. The output of the AGC circuit or sectioner is then applied to the mark amplifier which furnishes the necessary voltage and current for the stylus. Since Sonagram paper is current sensitive, as the signal strength increases the pattern becomes darker.

CIRCUIT DESCRIPTION, AMPLIFIER-ANALYZER SYSTEM

Record Amplifiers:

The record pre-amplifier, Q-1401 and Q-1402 provide the required additional gain for the two low impedance positions. When the INPUT SELECTOR switch is in the HIGH LEVEL position, the pre-amplifier stages are by-passed and the input signal if fed directly to the RECORD LEVEL control. This attenuated signal is then passed to the input of the RECORD AMPLIFIER (Module #1). Amplifier Q-101 provides a high input impedance and gain. A shaping network is employed in the emitter circuit of Q-102 for the HS analysis. The collector output of this stage provides gain for the VU monitoring system and differential amplifiers Q-103 and Q-104. The output of this differential amplifier is coupled to Q-105, an emitter follower, to provide a low output impedance. The signal is then fed to the RECORD-REPRODUCE head and impressed on the magnetic plating of the turntable. A feedback path is employed from the head to the base of Q-104, thus providing a flat recording current. Tuned circuit L-101, C-109, C-110 and C-111 are utilized to prevent the 75 KHz bias signal from feeding back to the record amplifier.

Bias Oscillator:

Record-Erase Bias Oscillator, Q-205, and Q-206 is activated when either the RECORD-REPRODUCE switch is in the RECORD position or when the CALIB switch is depressed. This oscillator produces a bias frequency of approximately 75 KHz. The output is fed to the head assembly and adjusted so that current is applied through the RECORD AND ERASE heads. As both heads are biased simultaneously, a continuous process of recording and erasing is taking place until the RECORD-REPRODUCE switch is placed in REPRODUCE. At this time, the recorded signal is "captured" on the turntable.

Calibrate Oscillators:

The calibrate oscillator consists of two multivibrators, one operating at 50 Hz and the other at 1000 Hz. The 1000 Hz signal is fed to transistors Q-607 and Q-608 which form a divide by 2 circuit, thus producing a 500 Hz signal. Each output is fed into an amplifier and a shaping network to provide an output rich in harmonic content.

Reproduce Amplifiers:

Reproduce pre-amplifier, Q-1601 provides a high impedance input and low frequency pre-emphasis. The output is coupled to Q-1602 and emitter follower Q-1603. The emitter follower utilizes a filter in its output to eliminate any extraneous 200 KHz signals from passing. After being attenuated by the REPRODUCE LEVEL control, the signal is fed to the REPRODUCE AMPLIFIER, (Module #2). Amplifier Q-201 and Q-202 are similar and provide high frequency shaping. Amplifier Q-203 contains a tuned circuit, L-201, C-1212, and C-213, to provide additional shaping at high frequencies. The output from the collector of Q-203 is coupled to emitter follower Q-204 which provides a low impedance drive to the low pass filter which rejects all frequencies above 96 KHz.

Monitor & VU Amplifier

A portion of the REPRODUCE OUTPUT is passed to the INPUT of the MONITOR & VU AMPLIFIER, (Module #3). Amplifier, Q-303, is activated only in REPRODUCE. In the RECORD mode, the signal is passed directly to the base of Q-301. Diodes D-301 and D-302 provide switching of the proper signal (RECORD OR REPRODUCE) to Q-302. Amplifier Q-302 provides the gain necessary to supply the VU meter. Diodes D-1201 thru D-1206 protect the meter from transients encountered when switching the mode of operation from RECORD to REPRODUCE and vice-versa. The MONITOR LEVEL controls the amount of signal applied to the base of the amplifier, Q-304. The signal then passes through emitter follower, Q-305, audio amplifier, Q-306, and is impressed across output transformer T-2, which matches the impedance of the speaker. A portion of the AUDIO OUTPUT is fed back to the emitter of Q-304, thus controlling the audible signal.

AGC Amplifier:

The output of the PLUG-IN FILTER may be selected to take one of two paths. When producing a #1 display and AGC action is desired, the signal is fed to the input of AGC & IF (Module #5), where it is passed through three transformer-coupled amplifiers, Q-501, Q-502 and Q-503. The output of Q-503 is coupled to amplifier, Q-505 and emitter follower, Q-504. This signal is then rectified and controls the biasing of the bases of Q-501, Q-502, and, thus, the gain of these stages. CR-501, in conjunction with the AGC action will be utilized to compress a full 40 DB of input to 10 DB, the range of the paper. For lower AGC control settings, the action will be cut out sooner, thus providing less compression.

When the AGC control is turned off, the filter output is fed to the base of Q-503, amplified, and passed to the IF OUTPUT: no compression is obtained.

Sectioner:

To produce a #2 display, (SECTION), the FILTER OUTPUT is fed to the input of the SECTIONER, (Module #8). Here the signal is passed through a series of amplifiers, rectified, and fed to the normally open contact of the Mercury-wetted relay, RV-801, in the form of a negative DC voltage, proportional to the amplitude of the input signal. This voltage charges capacitor C-805. The reed switch, S-11, mounted on the top of the stylus housing, is normally in the open position. When a magnetic pin passes the reed switch, the circuit is closed and the mercury-wetted relay is energized. The voltage on C-805 places a charge on C-807. When the magnetic pin has passed the reed switch, the relay is de-energized and C-807 discharges through R-812 and R-813, producing the familiar exponential decay curve at the base of emitter follower, Q-804. Q-805 acts effectively as a switch, which, under no signal conditions, shorts the base of Q-806. When the negative exponential signal appears, Q-805 is cut off, thus removing the short from Q-806. This allows Q-806, operating in conjunction with Q-807, to function as a multivibrator which oscillates at 200 KHz. The resultant output is a burst of 200 KHz, proportional in length to the amplitude of the input signal, measured in db, when a magnetic pin passes the reed switch. When the SECTIONER switch is ON, the voltages across the stylus resistor are inverted, thus producing a range of 8 KHz at the lower SHORT POINT to 0 KHz at the upper SHORT POINT.

Carrier Oscillator & Modulator:

The REPRODUCE OUTPUT is also fed through emitter follower, Q-401, to modulator transformer, T-402. At the same time, a voltage is impressed across the two legs of resistor, R-9, located in the stylus housing. The wiper contact of this resistor is mechanically linked to the Stylus Control and, as it moves up the Lead Screw, causes a constant voltage change at varactors, C-416 and C-417. This in turn causes the capacitance of the varactors and the frequency of Wien-Bridge Oscillator, Q-403 through Q-405, to vary in proportion. In the LINEAR mode of operation, LIN UPPER and LIN LOWER limit pots, R-1702 and R-1707, provide the proper voltage spread across the stylus resistor. Q-1701 provides the necessary voltage shaping needed to obtain uniform frequency variation with given stylus changes. In the LOG mode, R-1704, LOG UPPER, and R-1708, LOG LOWER limit pots control the voltage spread, while I-1701, a voltage variable resistance, provides a logarithmic voltage swing as the stylus moves up the screw. The output of the oscillator, (200 KHz - 296 KHz), is amplified by Q-402, and applied to modulator transformer, T-402. The sum, difference and carrier frequencies are present at the output of balanced modulator, CR-401 through CR-404. (A perfectly balanced modulator wouldn't permit any carrier leak; however, the modulator has been purposely unbalanced to provide a reference baseline when the stylus is just above the lower SHORT POINT). Q-1001, in the plug in filter, provides the correct impedance match for the crystal filters, FL-1001 and FL-1002, and compensates for the different insertion loss of these filters. Both filters are tuned to pass only 200 KHz at the effective bandwidths of 45 Hz and 300 Hz referred to the record speed, (the actual filter bandwidths are 12 times these frequencies). Therefore, only the carrier leak and difference frequencies of 200 KHz will be amplified and present at the output. Q-1002 matches the output impedance of the filters and provides additional gain.

Mark Amplifier:

The output of either the SECTIONER or the AGC circuits, depending on the mode of operation, is passed through the MARK LEVEL control to the input of the MARK AMPLIFIER (Module #7). This 200 KHz signal is taken from emitter follower Q-701 and passed to amplifier Q-702. This amplified output is transformer coupled to provide the phase splitting necessary to drive Q-703 and Q-704. The output of these stages are transformer coupled to the stylus to provide the proper voltage and current needed to burn the paper.

Record-Reproduce and Erase Heads:

Two separate heads are employed in the system: PU-1 is used for recording and reproducing; PU-2 is used for erasing. Both heads must be in intimate contact with the recording surface at all times. A rachet control is provided at the pivot point of each of the heads for the adjustment of head pressure. Means are also provided to allow for complete alignment of the head with reference to the turntable surface (this allows both vertical and horizontal freedom).

Turntable And Drive System:

The outer rim of the turntable is surfaced with a magnetic plating which is used for a recording medium. A synchronous, 2-speed motor, in conjunction with a friction drive system, causes the turntable to rotate at the selected speed when recording, and at 300 RPM when reproducing. The RECORD-OFF-REPRODUCE switch selects the mode of operation and controls the operation of the blower motor.

Stylus Assembly and Drum:

The small drum, on which the Sonagram paper is placed, is approximately 4" in diameter and 7" high. The micrometer plate, the drum and the turntable are locked together with a large knurled nut mounted on the top of the micrometer plate. The drum and turntable, being keyed to a common axis, rotate in synchronism. Two rolling springs are provided to hold the Sonagram in place around the drum. The lead screw, mounted on the stylus housing, is coupled in the drum assembly through a gear and pulley system. The gear ratio controlling the lead screw is such that 96 lines are produced on the Sonagram as the stylus moves one inch up the lead screw. The stylus itself is a length of 10 mil stainless steel wire, mounted in the throat of the hard rubber, fume exhaust tube. A bakelite disc, on the rear of the exhaust tube, permits the operator to adjust stylus pressure.

The stylus assembly also includes provisions for controlling the frequency limits of the Sona-Graph. An arm of the stylus control lever extends into the stylus housing and controls two wiper contacts. One contact moves up a cermet resistor, R-9, thus controlling the varactor bias and the frequency of the carrier oscillator. The second contact moves up a strip which contains two grounded terminals approximately 4" apart. When the stylus control reaches either of these short points, the input of the MARK AMPLIFIER board is shorted to ground, preventing any stylus marking and causing SHORT POINT indicator, I-1, to light.

The REED SWITCH BLOCK AND POINTER, both a part of the SECTIONER circuit, are located on the top of the stylus housing. When the SECTIONER circuits are activated, a magnetic pin passing the reed switch will close the circuit and energize relay RV-801 in the sectioner circuits. The pointer can be utilized in conjunction with the stylus wire to SECTION a pre-selected portion of #1 display.

Blower Motor Assembly:

In the process of making a Sonagram, a considerable amount of smoke is generated. This smoke is drawn off via the hard rubber tube on the stylus holder and is passed through a flexible rubber tube which terminates at the filter and blower motor assembly.

ALIGNMENT PROCEDURE

INTRODUCTION

This section contains all the information necessary to complete a factory alignment of the Sona-Graph, 6061-B.

If any problems are encountered while performing these alignment checks, consult the Maintenance Section for possible malfunctions.

FUNCTION OF INTERNAL CONTROLS, 6061-B

CONTROL	COMPONENT	FUNCTION
B+ ADJ	R-905	Adjusts the proper 18v output from the power supply.
LOG UPPER LIMIT LOG LOWER LIMIT LIN UPPER LIMIT LIN LOWER LIMIT	R-1704 R-1708 R-1702 R-1707	Adjustments for setting the proper voltages at the top and bottom of the stylus resistor to provide correct frequency spread.
BIAS ON-OFF Switch	S-1 (OFF)	De-activates the bias oscillator circuits, (used during alignment of record circuits.)
BIAS ADJ	C-1608	Controls amount of bias applied to the record head.
75 KHz TRAP ADJ	C-1610	Keeps 75 KHz bias signal from feeding back into the record amplifiers.
200 KHz TRAP ADJ	L-1601	Tuned to keep 200 KHz signals out of the reproduce amplifier.
RECORD VU ADJ REPRODUCE VU ADJ	R-305 R-312	Control the amount of record and reproduce signal present at the VU meter.
MODULATOR BALANCE	R-407	Provides the correct balance between the carrier and reproduce frequencies.
FEEDBACK ADJ	R-415	Controls the amount of negative feedback required to cause the carrier oscillator to oscillate.
0 DB ADJ 20 DB ADJ 40 DB ADJ	R-503 R-509 R-524	Controls AGC diode action. Controls IF amplifier gain. Controls AGC amplifier gain.

50 Hz ADJ 500 and 1000 Hz ADJ	R-603 R-618	Controls frequency of the calibration oscillator.
MAXIMUM AMPL ADJ	R-812	Controls the maximum length of the sectioner pulse.
MINIMUM AMPL ADJ	R-824	Controls the minimum length of the sectioner pulse.

ALIGNMENT PROCEDURE, SONA-GRAPH, 6061-B

EQUIPMENT REQUIRED:

Oscilloscope, Tektronix 503, or equiv.
AC Voltmeter, Ballantine, Mod. #861, or equiv.
Attenuator, 70 ohm, Kay Mod. 21-0
Frequency Counter, Berkeley/
Beckman Mod. #554 or equiv.
Audio Oscillator, Hewlett-Packard,
Mod. 220-C or equiv.
DC Voltmeter, RCA Voltohmyst, or equiv.

A. POWER SUPPLY

1. Connect a VTVM and oscilloscope across C6, and check for +18 volts with less than 2 mv p-p ripple. Adjust R-905 if necessary.

2. Connect the VTVM and oscilloscope across CR-912, and check for -6.8 volts with less than 10 mv p-p ripple. This voltage should be within ± 10%.

3. Measure between the (-) side of C-905 and ground; check for -36 volts with less than 2 volts p-p ripple. This voltage should be within ± 20%.

NOTE: If any printed circuit modules are plugged in or taken out of the Sona-Graph, make certain the unit is turned OFF. This is to prevent transients from damaging the semiconductors.

B. RECORD BIAS

1. Turn the bias switch, at the rear of the electrical unit, to ON.

2. Turn the RECORD-OFF-REPRODUCE switch to RECORD.

3. Connect one lead of a wide-band AC voltmeter to the relay side of R-1614, and connect the other meter lead to ground.

4. Tune C-1608 to obtain a 2.4 VRMS reading on the meter.

5. Connect the scope, with a high-impedance probe, to the RECORD OUTPUT test jack.

6. Tune C-1610 for a minimum reading on the scope (6 volts p-p or less).

C. CALIBRATE TONE

1. Connect a counter to the CALIBRATE switch wiper arm. Place the switch in the 50 Hz position.

2. Adjust R-603 for a reading of 50 Hz on the counter.

3. Place the switch in the 1 KHz position. Adjust R-618 for a reading of 1 KHz on the counter.

D. 200 KHz TRAP

1. Turn the BIAS switch at the rear of the unit to OFF, the Mechanical Shift Level to OFF, and the RECORD-REPRODUCE switch to REPRODUCE.

2. Connect a 200 KHz oscillator (240 mv p-p) to the base of Q-1610 in the Reproduce amplifier.

3. Connect the scope to the junction of R-1611 and L-1601, and tune L-1601 for a minimum reading on the scope.

E. CARRIER OSCILLATOR

1. Set the MARK LEVEL control at (0), and the BASELINE control at midpoint.

2. Connect a counter to the CARRIER OSCILLATOR test jack through a 100 K resistor.

3. Move the stylus to the top of its travel; then slowly bring it down until the SHORT POINT light goes out. Partially engage the stylus. (DO NOT ALLOW THE STYLUS WIRE TO TOUCH THE DRUM).

4. Turn the FREQ. SCALE to the LIN position.

5. Connect the positive lead of a VTVM to the junction of CR416 and CR417 (on Module #4), and the negative lead to chassis ground. Then adjust the LIN UPPER pot (R-1702) for a 10 volt meter reading.

6. Remove the VTVM and adjust R-415 to obtain a 296.7 KHz reading on the counter. Succeeding 296.7 KHz linear adjustments are to be done with LIN UPPER CONTROL.

7. Switch the FREQ. SCALE selector to the LOG position, and adjust the LOG UPPER pot (R-1704) to obtain 296.7 KHz.

8. Lower the stylus to the bottom of its travel; then slowly raise it until the SHORT POINT light just goes out. Partially engage the stylus.

9. Adjust the LOG LOWER pot (R-1708) to obtain 199.7 KHz on the counter.

10. Turn the FREQ SCALE switch to the LIN position, and adjust the LIN LOWER pot (R-1707) to obtain a 199.7 KHz reading.

11. Recheck the UPPER LIMIT frequencies, and readjust the pots if necessary. (Do not readjust R-415).

F. RECORD-REPRODUCE HEAD

1. Turn the shaping selector to FL-1, and the BIAS switch (rear of unit), to OFF.

2. Turn the RECORD-REPRODUCE switch to RECORD and the RECORD LEVEL CONTROL to approximately (20).

3. Feed in a 2.5 KHz signal and turn the INPUT SELECTOR to the appropriate matching impedance.

4. Monitor the junction of R-1614 and the relay (on the mechanical unit) with a wide-band AC voltmeter. Adjust the input to obtain a reading of 240 mv rms.

5. Turn the BIAS switch to ON, place the RECORD-OFF-REPRODUCE switch in RECORD, place the RANGE switch in the 8 KHz position. Record the 2.5 KHz signal.

6. Now monitor the output in REPRODUCE by connecting the AC voltmeter to the input of the Reproduce Pre-amplifier. Adjust the heads until a maximum output is obtained, this output should be between 42 and 52 db above 1 mv. In order to obtain a maximum head output, it is necessary to rerecord the signal each time the head adjustments are moved, also remove the AC voltmeter while recording the signal. When the maximum level is found, readjust the record level to obtain a head output of 42 ± 1 db. Then readjust R-305 (Module #3) to obtain a reading of 0 VU on the meter.

7. If the proper reading cannot be obtained in

Step 6, the bias noted in Step B-4 may be varied slightly (± 10%).

G. SYSTEM FLATNESS

1. Set the SELECTOR switch to FL-1, and the INPUT SELECTOR to the correct matching impedance for the CW oscillator.

2. Set the RECORD-REPRODUCE switch to RECORD, the BIAS switch to OFF, and the REC-OFF-REP switch to RECORD.

3. With the AC voltmeter on the relay side of R-1614, apply a 2.5 KHz signal to the INPUT jack and set the oscillator for a 240 mv rms reading on the meter.

4. Check to see that there is a zero VU reading on the panel meter. If the reading is improper, adjust R-305 (Module #3) to obtain zero VU.

5. Return the BIAS switch to ON, and record the 2.5 KHz signal on the 8 KHz range.

6. Reproduce the signal in the normal manner, and monitor the REPRODUCE OUTPUT test jack with the AC voltmeter.

7. Set the REPRODUCE LEVEL control to obtain approximately 80 mv volts rms on the meters.

8. Maintaining the same input level, record and reproduce signal frequencies throughout the 80-8000 Hz range. The AC voltmeter readings should not vary by more than ± 2 DB over the entire range.

9. If the flatness is slightly out of specification, the bias level may be changed by a small amount (± 10%) to improve the response.

NOTE: It should be ascertained that the RECORD-REPRODUCE heads and the recording surface are clean before performing Steps F & G.

H. REPRODUCE VU METER

1. Leave the 6061-B set up as it was for the System Flatness check (the 2.5 KHz signal being played back continuously).

2. Connect vert of scope to FILTER OUT jack. Lift the stylus to a point where an IF output is observed on the scope. This will occur approximately one-third the way up the Lead Screw.

3. Move the stylus carefully until the peak output is noted; then turn the REPRODUCE LEVEL control to obtain 0.55 volts p-p (± 10%) on the scope.

4. The stylus may now be returned to its rest position.

5. Adjust R-312 (Reproduce VU Level) Module #3 to obtain a reading of (-2) on the front panel VU meter.

6. Check the Level at the REPRODUCE OUTPUT test jack, it should be from 200 to 270 mv p-p.

I. AGC

1. Switch the 6061-B to the REPRODUCE mode.

2. Remove the 200 KHz filter plug-in from the 6061-B. Raise the stylus to a point midway between short points and set the mark level to zero.

3. Connect the equipment as shown in Fig. 3-2.

4. Set the output of the oscillator to obtain a reading of 0.55 volt p-p on the scope (with no attenuation in the circuit).

5. Connect a wide-band AC voltmeter to the IF OUTPUT test jack, and switch in 40 DB of attenuation. Set the AGC control at maximum, and adjust T-501 & T-502 (Module #5) for maximum output.

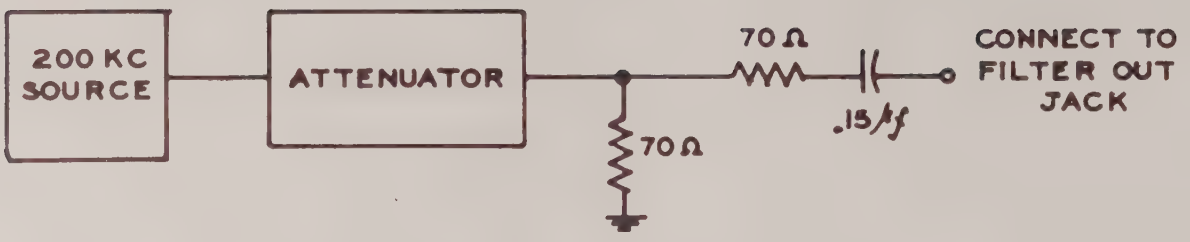


FIG. 3-2 AGC TEST EQUIPMENT HOOK-UP

6. Now adjust R-509 (Module 5) to produce a reading of 2 DB below 0.1 volt rms on the AC voltmeter.

7. Remove 20 DB of attenuation from the circuit, and adjust R-524 so that the output increases by about 7 DB from the -40 DB level.

8. Remove all attenuation from the circuit, and adjust R-503 until the output increases by about 3 DB over the -20 DB level.

9. Repeat the three preceding steps until the best results are obtained.

10. Reset the AGC control at minimum; the voltmeter should now read 2.4 volts ± 0.5 volts DB.

11. Reset the AGC in the OFF position. Remove the 20 DB attenuation. The voltmeter should now read approximately 1.3 volts, rms.

J. MODULATOR BALANCE

1. See that the 6061-B is in the REPRODUCE mode and the BAND SELECTOR is in the NARROW position.

2. Lift the stylus to a point just above the position where the SHORT POINT indicator goes out.

3. Connect an oscilloscope to the FILTER OUTPUT test jack, and rotate the BASELINE control to obtain a peak reading on the scope.

4. Now adjust R-407 (Module #4) for a reading of approximately 100 mv p-p, while continuously varying the BASELINE control for peak output.

K. SECTIONER

1. Place the power switch in the OFF position.

2. Install six magnetic pins equally spaced around the top to the Sectioner Micrometer Plate. Loosen the two screws securing the Reed Switch Block to the Sectioner and slide the Reed Switch Block and Pointer towards the Drum. Slowly rotate the Drum by hand and position the Reed Switch Contact so that it is approximately 1/16" from by passing magnetic pin, (Fig. 3-3). Rotate the Drum 360° and see that the pins clear the switch contact by at least 1/32".

NOTE: If the magnetic pins pass too close to the Reed Switch Contact, the switch may tend to "Hang", in a closed position; if the switch is too far from the pins, the Reed Switch may fail to close.

3. Connect the equipment as described in Step I.

4. Place the POWER and SECTIONER switches in the ON position. Place the mechanical shift lever in the reproduce position.

5. Connect the scope to the base of Q-803, and adjust the output of the oscillator for a negative

35 V peak exponential. (The input should be approximately .55 volts peak to peak.)

6. Connect the scope to the SECTIONER OUT jack and adjust R-812 for a pulse width of 21.0 ms.

7. Switch in 35 DB of attenuation and adjust R-824 for a pulse width of 0.3 ms.

8. Repeat Steps 6 & 7 until the proper results are obtained.

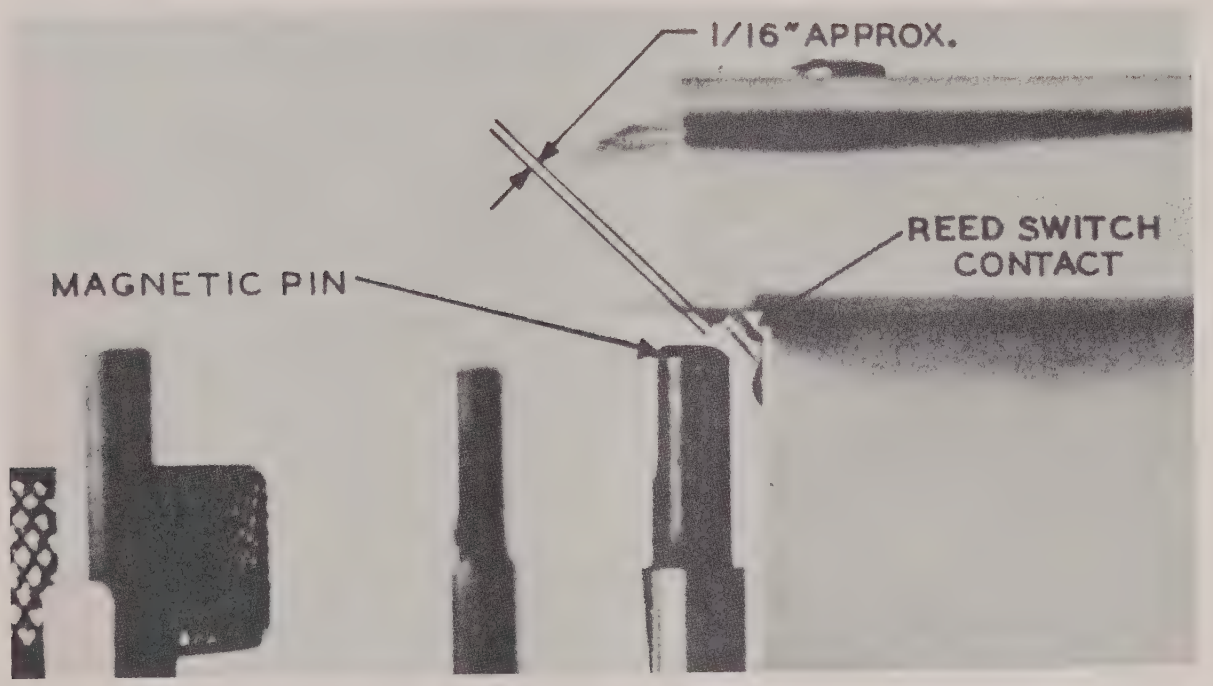


FIG. 3-3 PROPER REED SWITCH BLOCK ADJUSTMENT

VISUAL INSPECTION

The 6061-B should be visually inspected regularly, usually during periodic maintenance checks, for such things as loose or broken connections, cracked terminal strips, dirty recording head or surfaces, and faulty stylus adjustment. The recording surface especially should be cleaned regularly. Signs of overheating such as scorched wires or resistors, discolored casings or melted wax may indicate other less apparent troubles.

PARTS REPLACEMENT

Most components of this instrument are easily accessible and require no special replacement procedures. However, since some of the solid-state components used may be damaged when subjected to intense heat, avoid overheating when soldering the leads of these components. Long-nose pliers may be used as a heat sink between the component and the tip of the soldering iron. The soldering iron should be hot before touching the solder joint, and removed immediately after the solder flows. The tip of the iron should be electrically at ground potential so that semiconductor components having low voltage ratings will not be damaged.

PARTS LOCATION

Due to the complexity of the Sona-Graph, the electrical system has been divided into seventeen separate systems to facilitate location and replacement of parts. These individual circuits are listed below and on Figures 3-4 and 3-5. Major components designations and printed circuit component designations are screened on the chassis or module.

	Component Designation	Circuit Location
A	1-99	Main Chassis
B	100-999	Record Module#1
C	200-299	Reproduce Module #2
D	300-299	Monitor & VU Module #3
E	400-499	Carrier Osc & ModulatorModule #4
F	500-599	AGC & IF Module #5
G	600-699	Bias & Calib Module #6
H	700-799	Mark Amplifier Module #7
I	800-899	Sectioner Module #8
J	900-999	Power Supply
K	1000-1099	Filter Module
L	1100-1199	6076-C Plug-in
M	1200-1299	VU Meter
N	1300-1399	Low-Pass Filter
O	1400-1499	Record Pre-Amplifier
P	1500-1599	Reproduce Pre-Amplifier
Q	1700-1799	LOG-LIN Freq. Adj.

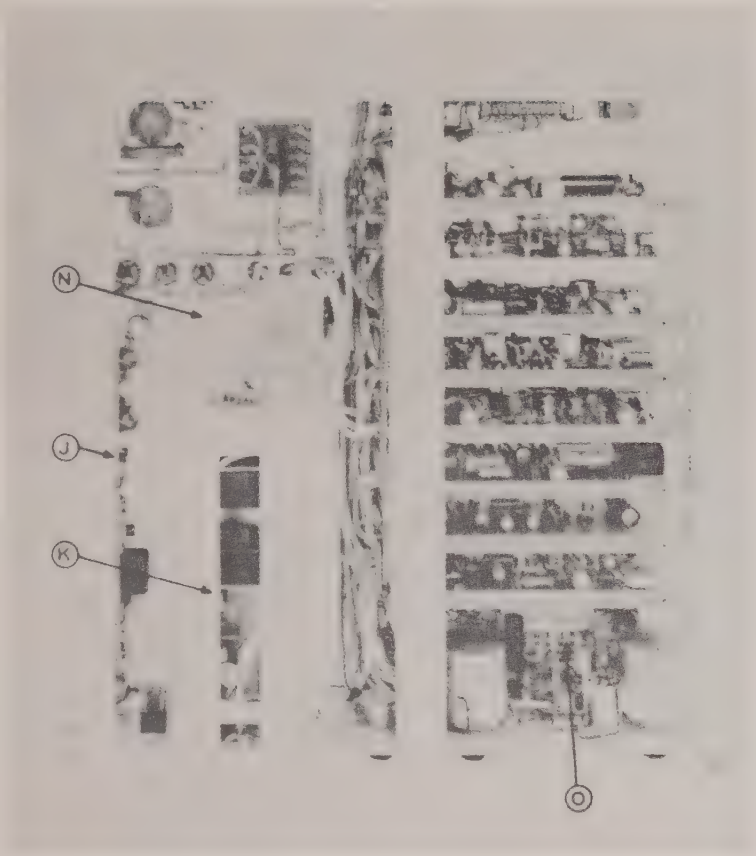


FIG. 3-4 ELECTRICAL SYSTEM, BOTTOM

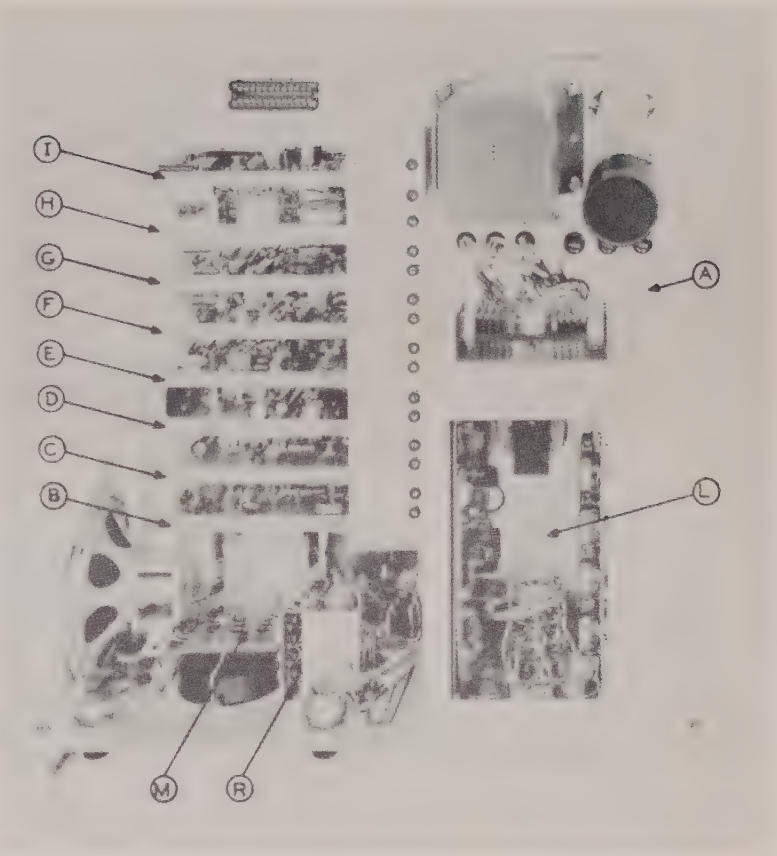


FIG. 3-5 ELECTRICAL SYSTEM, TOP

DISASSEMBLY OF THE MECHANICAL SYSTEM

The following procedures are included in this section to facilitate preventative maintenance programs, but should also prove helpful when troubleshooting the instrument.

REMOVAL OF MECHANICAL UNIT FROM CABINET

A. Remove rear grille and disconnect multi-conductor power cable, 3-conductor Mark Amplifier cable, and 2 conductor power cable.

B. Remove (4) #4-40 screws and corner cover plate from top to unit.

C. Remove (6) #6-32 screws from top cover plate.

D. Remove REC-OFF-REP knob & RANGE SELECTOR knob. Remove the top cover plates.

E. Remove (8) #6-32 screws from the top of the mechanical system casting. The mechanical assembly is now free to remove from the cabinet.

F. Reverse procedure to reassemble mechanical system.

REMOVAL OF DRUM AND TURNTABLE

A. Loosen the Stylus Housing "Lock" nut, disconnect stylus drive belt and slide the housing away from the drum.

B. Loosen the Sectioner Plate lock nut and swing the Sectioner Plate away from the drum.

C. Remove the drum lock nut and Sectioner Micrometer Plate. Holding the turntable itself in a fixed position, slide the drum off over the turntable shaft.

D. Secure the Record and Erase heads away from the recording surface and hold the turntable brake back. Now lift the turntable out of the main bearing.

CAUTION: Allowing the heads to strike the turntable may throw the system out of line or may damage the heads and recording surface. When removing the turntable, maximum care should be exercised.

REMOVAL OF STYLUS RESISTOR

A. Remove the (4) #4-40 screws holding the Stylus Housing cover. Remove cover.

B. Remove the (2) #6-32 screws from the record head side of the housing, freeing the Stylus Resistor assembly.

C. Loosen the stylus lock nut and provide slack in the cabling.

D. Ease the entire assembly out of its cavity.

CLEANING AND LUBRICATING THE MECHANICAL SYSTEM

Cleanliness of the mechanical system of the 6061-B is essential for obtaining clear, sharp, accurate information on the Sonagram pattern. The recording head and turntable surface especially should be cleaned periodically for optimum performance.

CLEANING THE RECORDING SYSTEM

The Record and Erase heads and turntable should be cleaned monthly during normal operation with a clean cloth dampened with polycloreythelene.

CLEANING THE MARKING STYLUS ASSEMBLY

The housing may be cleaned periodically by removing the cover plate and blowing out any accumulated dust with compressed air. The stylus wire itself, located in the neck of the Fume Exhaust Tube, should be readjusted

periodically so that proper contact is made with the paper. The lead screw which drives the stylus holder should not be allowed to run dry. A light coat of petrolatum should be applied to the lead screw and the excess lubricant removed with a clean cloth. A drop or two of light oil should be applied to the bearings which support the lead screw whenever the lead screw itself is lubricated.

EXHAUST SYSTEM

The exhaust tube itself should be cleaned as required to permit passage of air through the exhaust system. The filter consists of two separate filters, one a particle trap, and the other a carbon filter. If the unit fails to draw the smoke and particles off of the paper, the filters may need cleaning.

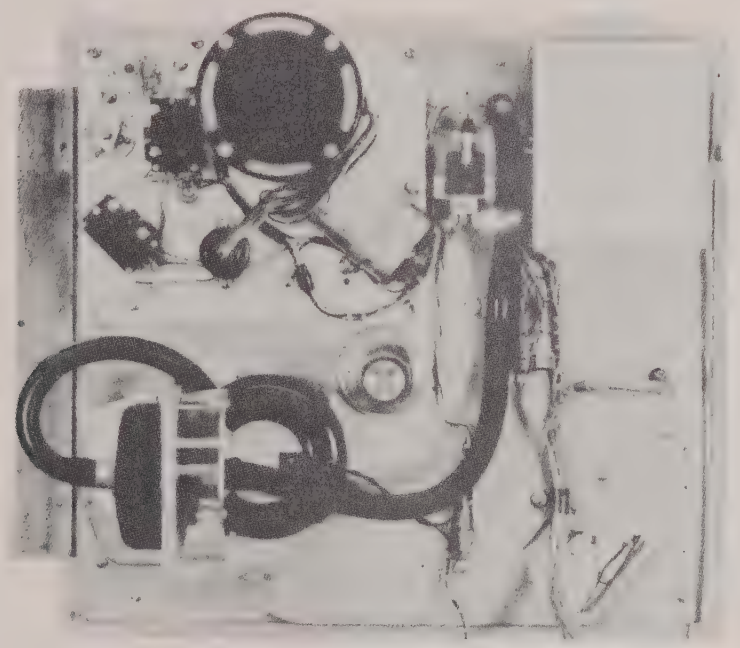


FIG. 3-6 MECHANICAL ASSEMBLY, BOTTOM

DRIVE SYSTEM MAINTENANCE

Remove the drum and turntable as indicated on Page 3-14. The drive wheels may now be cleaned with a clean cloth dampened in alcohol.

TROUBLESHOOTING DATA

This section contains information, voltage charts, and call-out photographs for use in servicing the Sona-Graph. To minimize unnecessary labor, try to use the alignment and preventative maintenance procedures before attempting any repairs. Certain abnormalities can be compensated for, using the proper adjustments.

To maintain the reliability of this instrument, always realign any portion that has been repaired. If the power supply circuits have been serviced, it is wise to perform the check-outs in the Operator's Manual, if these checks reveal that functions are not within specifications, follow the appropriate portion of the alignment procedure.

UNIT IS BOTH ELECTRICALLY AND MECHANICALLY INOPERATIVE

If the pilot lamp is out and the mechanical system fails to operate, check fuses F-2 and F-1, the line cord, the POWER switch, and Plug-Jack 901 combination for continuity. Check also to see the plug-in unit is firmly seated in its cavity.

UNIT IS MECHANICALLY INOPERATIVE, BUT ELECTRICALLY NORMAL

Check the continuity of PJ-14 pins 1&4, PJ-12, and PJ-15. If these checks fail to reveal an open circuit, check the continuity of the motor (B-1) itself.

MECHANICAL SYSTEM IS NORMAL; NO SIGNAL CAN BE RECORDED

If the pilot lamp is out, check the continuity of the power transformer primary.

If the pilot lamp is on and the VU meter does not give any indication, check to see if the short point lamp is lit with the electrical in REPRODUCE mode and the stylus at the bottom of its travel. If the SHORT POINT indicator does not light, check Fuse F-3 and the +18 volt supply circuit for proper DC levels. The levels should be similar to those given below.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1	+18.0	+18.9	+31.0
Q901	+19.4	+20.0	+31.0
Q902	+6.5	+7.0	+20.0
Q903	+18.9	+19.4	+31.0

If the above checks fail, check T-1 secondary and diodes CR-1 through CR-4.

If the SHORT POINT indicator lights, check the gain of the record amplifiers as follows:

Feed an audio signal of 2.5 KHz into the INPUT jack and adjust the oscillator for an output of 300 mv peak-to-peak. With the RECORD LEVEL set to approximately "20," connect a scope to pin 5 of PJ1. Gain voltages similar to those found on schematic B-7756 should be obtained. DC levels (± 10%) are given in the table below.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1401	+2.9	+3.5	+9.3
Q1402	+8.7	+9.3	+18.0
Q101	+3.6	+4.2	+7.2
Q102	+6.6	+7.2	+11.2
Q103	-1.8	-1.1	+18.0
Q104	-1.5	-0.9	+8.0
Q105	+7.3	+8.0	+18.0

If a meter indication and proper output at pin 2 of Module #1 is obtained, check the continuity of record head PU-1, check also to see that proper bias is obtained per the alignment precedure. The following DC levels are typical of the biasing circuits.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q205	0	-7	+15
Q206	0	-7	+15

UNIT FAILS TO ERASE PROPERLY

Check the DC levels as noted above and the continuity of Erase Head, PU-2.

PLAYBACK SIGNAL IS NOT PRESENT

If the system fails to mark the paper and the monitoring systems (VU meter and speaker) do not indicate normal signal strength, check the REPRODUCE PRE-AMPLIFIERS Q1601, Q1602, and Q1603, the REPRODUCE AMPLIFIERS on Module #2, and the continuity of the low pass filter. Refer to the table below for approximate DC levels.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1601	-0.6	0	+6.8
Q1602	+4.5	+5.1	+7.3
Q1603	+6.7	+7.3	+18.0
Q201	+3.7	+4.3	+6.8
Q202	+3.4	+4.0	+7.5
Q203	+6.0	+6.7	+9.9
Q204	+9.2	+9.9	+18.0

SYSTEM FAILS TO MARK PAPER: RECORD AND REPRODUCE FUNCTIONS ARE NORMAL

First check the stylus wire itself to make sure it is making contact with the paper and the 3-conductor MARK AMPLIFIER cable to ascertain that it is properly connected to its jack on Module #7.

If these checks fail to reveal the source of trouble, check the circuitry of the CARRIER OSCILLATOR AND MODULATOR Module #4 by connecting an oscilloscope to the CARRIER OSCILLATOR OUTPUT TJ-19. With the stylus slightly above the lower short point, the FREQ. SCALE switches in the LIN and NORMAL positions and accessory plug-in function switch in the OFF position, an output of approximately 25 volts peak-to-peak at 200 KHz should be obtained. Raise the stylus slowly and note a constant change in frequency. If the rate of change is abnormal, check the stylus resistor circuitry for continuity. If no output is obtained, check the characteristics of the oscillator and output stages of Module #4. Typical readings are given below.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q401	+6.4	7.8	+16
Q402	+2.0	2.5	+15
Q403	+8.2	+8.8	+15
Q404	+3.4	4.0	+8.8
Q405	+3.3	+3.9	+8.4

If Module #4 is operating satisfactorily, check the circuitry of MARK AMPLIFIER Module #7 and AGC-IF Module #5 as follows:

Record and reproduce a 2.5 KHz signal at "0" VU. Set the AGC control to "0" and the MARK LEVEL to "2". Connect an oscilloscope to FILTER OUT test jack, TJ-25. Raise the stylus to a point at which the 2.5 KHz signal peaks (with the mechanical system in reproduce) at approx. .55 volts peak-to-peak. If this reading is not obtained, check the DC, levels of Q1001 through Q1003 using the table below.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1001	1.6	2.3	7.1
Q1002	2.0	2.6	10.4
Q1003	9.6	10.4	18.0

If the FILTER OUTPUT is normal connect the scope to TJ-21 (IF OUTPUT), raise the stylus to the point at which the 2.5 KHz signal is obtained. If an output of approx. 4.9 volts is not noted on the scope, check the DC levels on Module #5.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q501-502	Conditions vary depending on AGC action involved.		
Q503	1.9	2.5	8.8
Q504	9.6	10	16.5
Q505	1.9	2.5	10

If the IF output is normal, check the DC levels of MARK AMPLIFIER Module #7. Typical readings are given in the table below.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q701	3.3	3.9	17.0
Q702	2.6	3.3	16.0
Q704-5	levels vary - *B+* is unregulated		

SECTIONER FAILS TO FUNCTION

If the SECTIONER portion fails to operate normally, first check the Reed Switch Block to see that it is properaly adjusted and that it closes as a Magnetic Pin passes it. This may be checked by connecting an ohmmeter across the terminals on the Reed Switch Block and rotating the drum by hand. Finally, check the continuity of CR801, CR802, and K801 and DC levels of Module #8.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q801	2.4	3.0	8.0
Q802	7.5	8.0	16.0
Q803	2.0	2.6	16.0
Q804	-1.0	- .2	0
Q805	-1.0	- .5	-1.5
Q806	1.3	-1.6	17.0
Q807	1.3	1.8	+1.4

MONITOR SYSTEM FAILS TO FUNCTION

If the SONA-GRAPH is working normally but the VU and speaker systems fail to operate, check the circuitry of Module #3. Typical DC levels are included in the table below.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q301	4.0	4.7	7
Q302	3.8±.3	4.5	9.0±1
Q303	5.4±1	6.0	9.7±1
Q304	2.6±.3	3.3	8.2±1
Q305	2.9±.3	3.5	18
Q306	2.3±.3	2.9	17

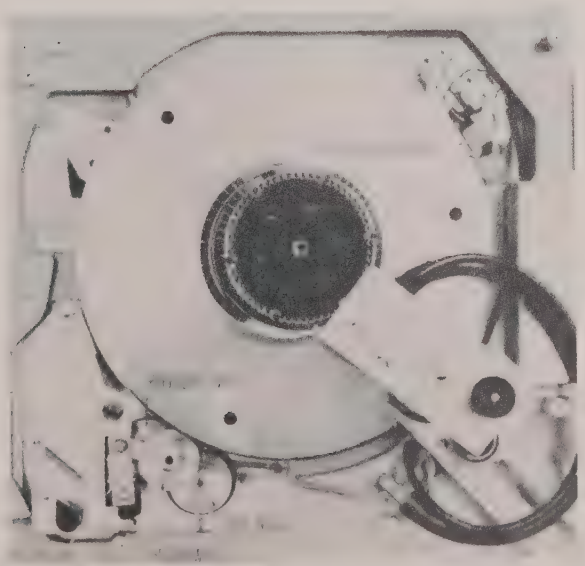


FIG. 3-7 MECHANICAL DRIVE SYSTEM

FREQUENCY VARIATIONS NOTED IN CALIBRATION LINES

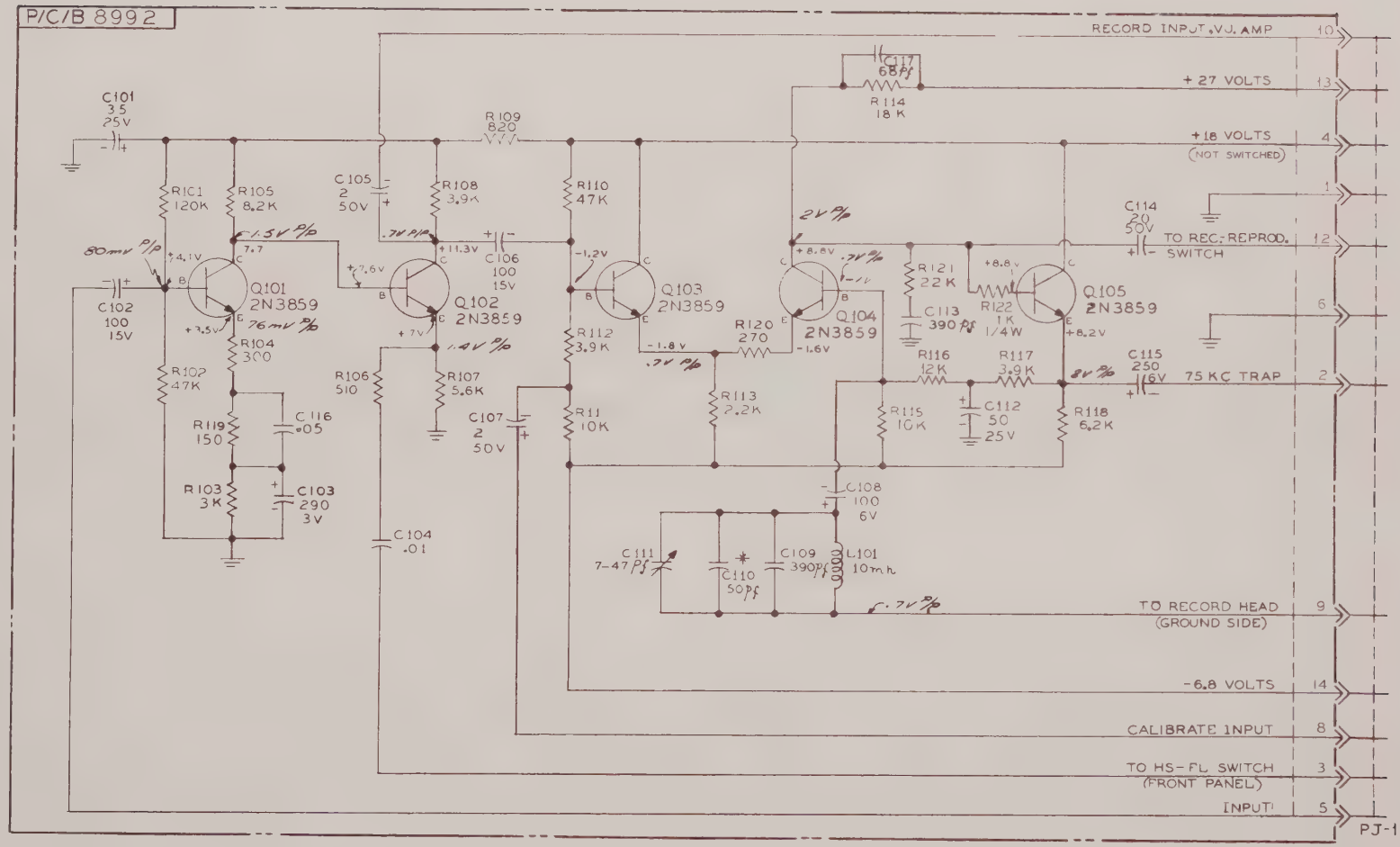
The RECORD-OFF-REPRODUCE SELECTOR switch should be left in the OFF (neutral) position when the SONA-GRAPH is not in use to prevent a flat from developing on the drive wheels, which will appear as excessive "wow" on the Sonagram. Excessive variations in the calibration lines indicates that the drive wheels are dirty. The wheels may be cleaned by using a clean cloth dampened with alcohol (the use of carbon tetrachloride is not suggested, as it will damage the high friction material on the drive wheels).

RESHIPMENT INSTRUCTIONS

Permission to return equipment should be obtained from the factory or an accredited Kay representative before return shipment is made. If it is necessary to return the 6061-B for repair, pad it securely for transit. A packing slip should be included in the carton furnishing identification of the shipper, as well as the instrument type and serial number. Also, include a statement indicating the malfunction for the benefit of service personnel.

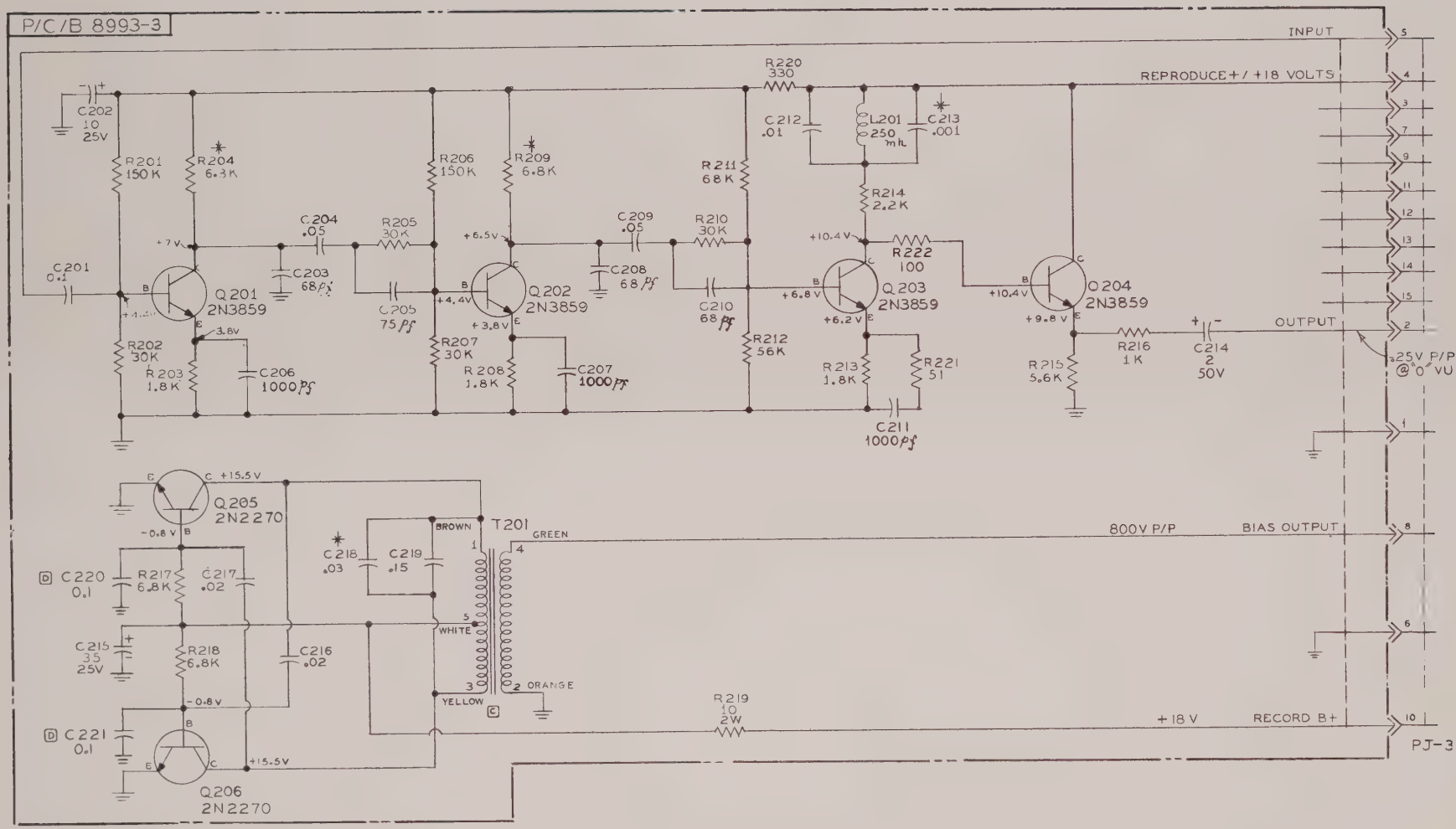
SECTION 4

SCHEMATICS



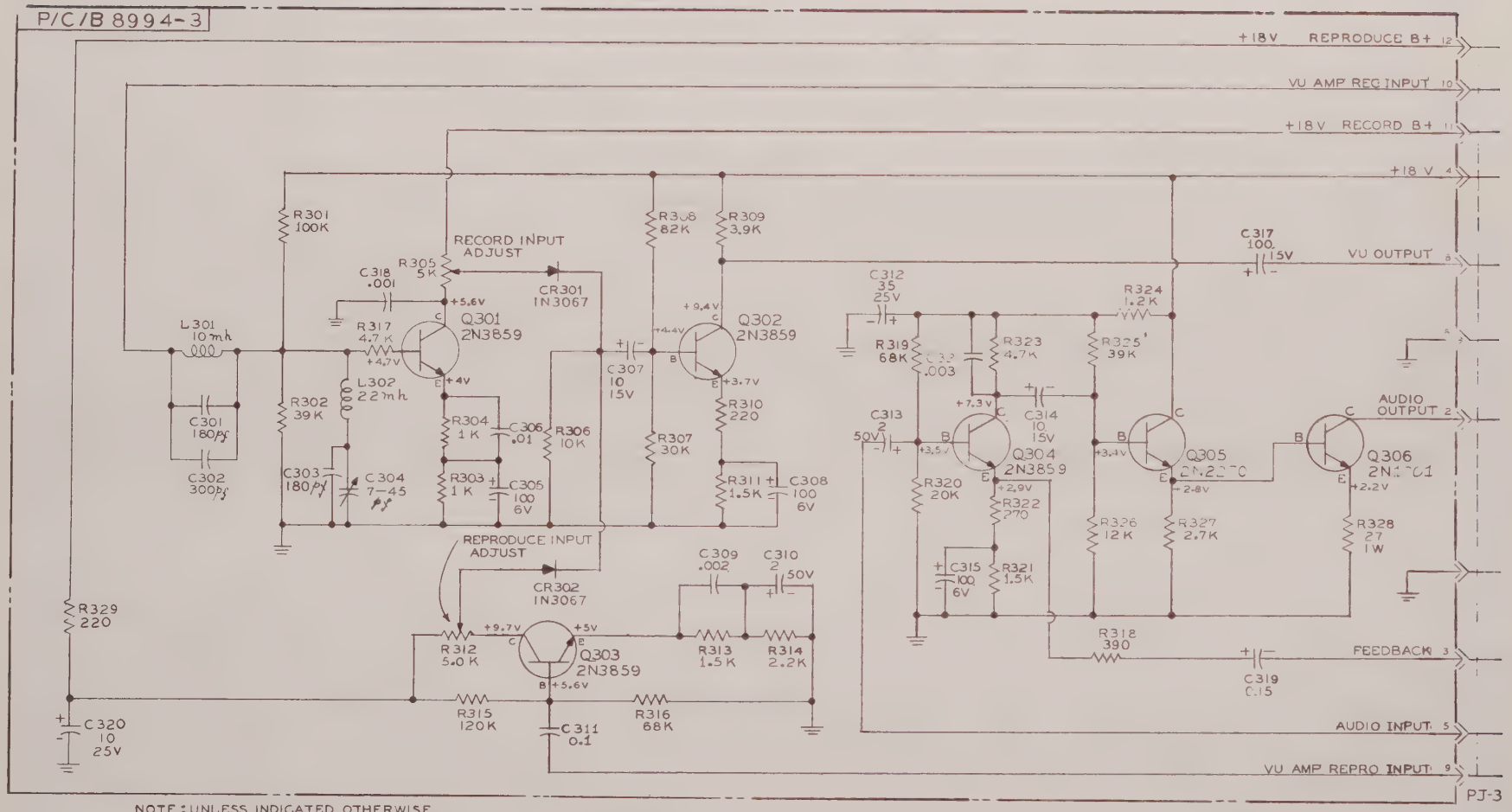
NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/2 W
ALL CAPACITANCES ARE IN Mf
* FACTORY SELECT
ALL AC VOLTAGES TAKEN AT 2.5 KHz, 0 VU
Ⓓ AND RESPONSE SHAPING SWITCH SET AT FL-1

DWG. NO. B8992 G RECORD AMPL. - BOARD #1



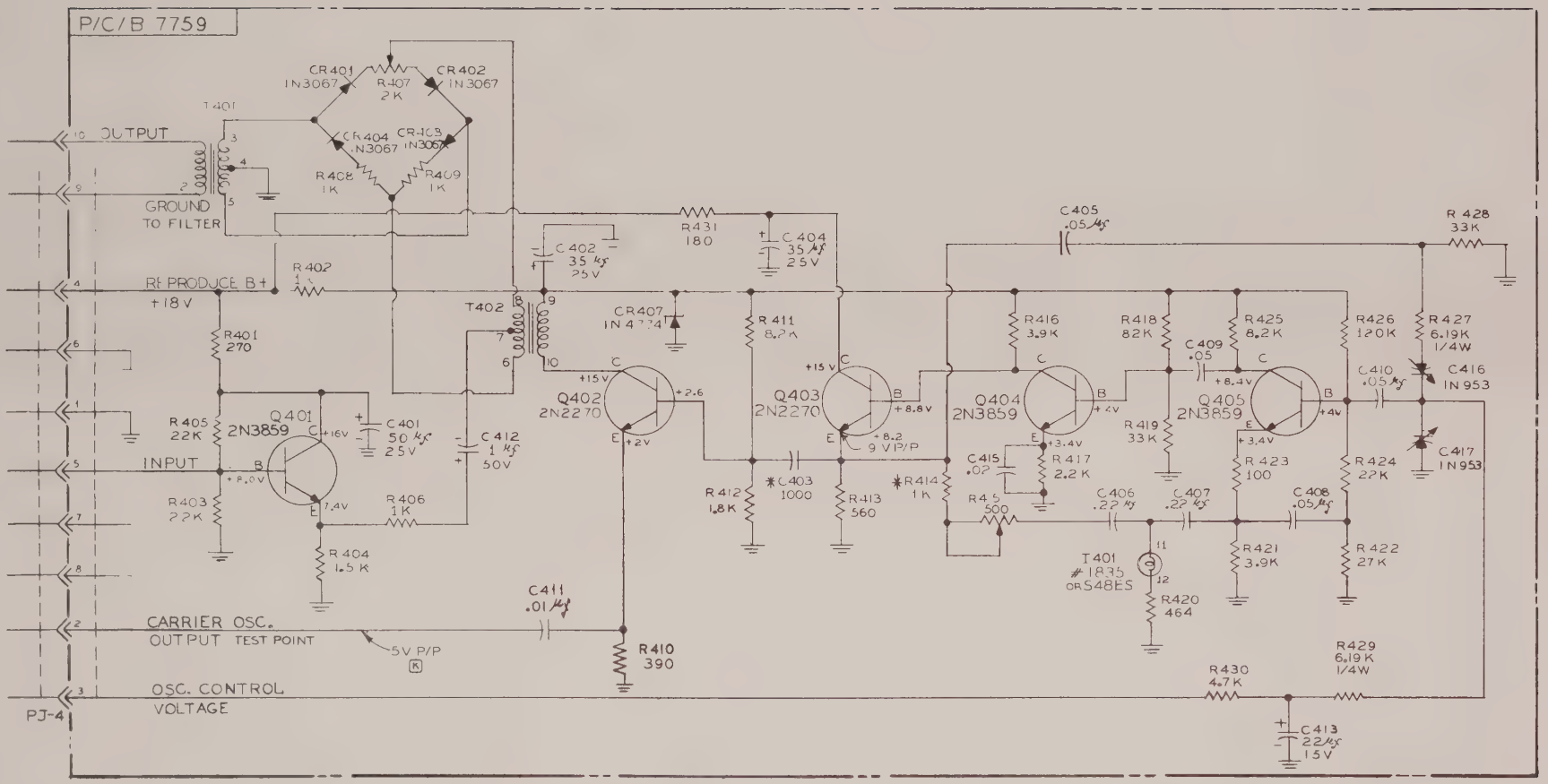
NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/2 W
ALL CAPACITANCES ARE IN μf
✱FACTORY SELECT

DWG. NO. B8993 L REPRODUCE AMPL. + BIAS OSC. - BOARD #2



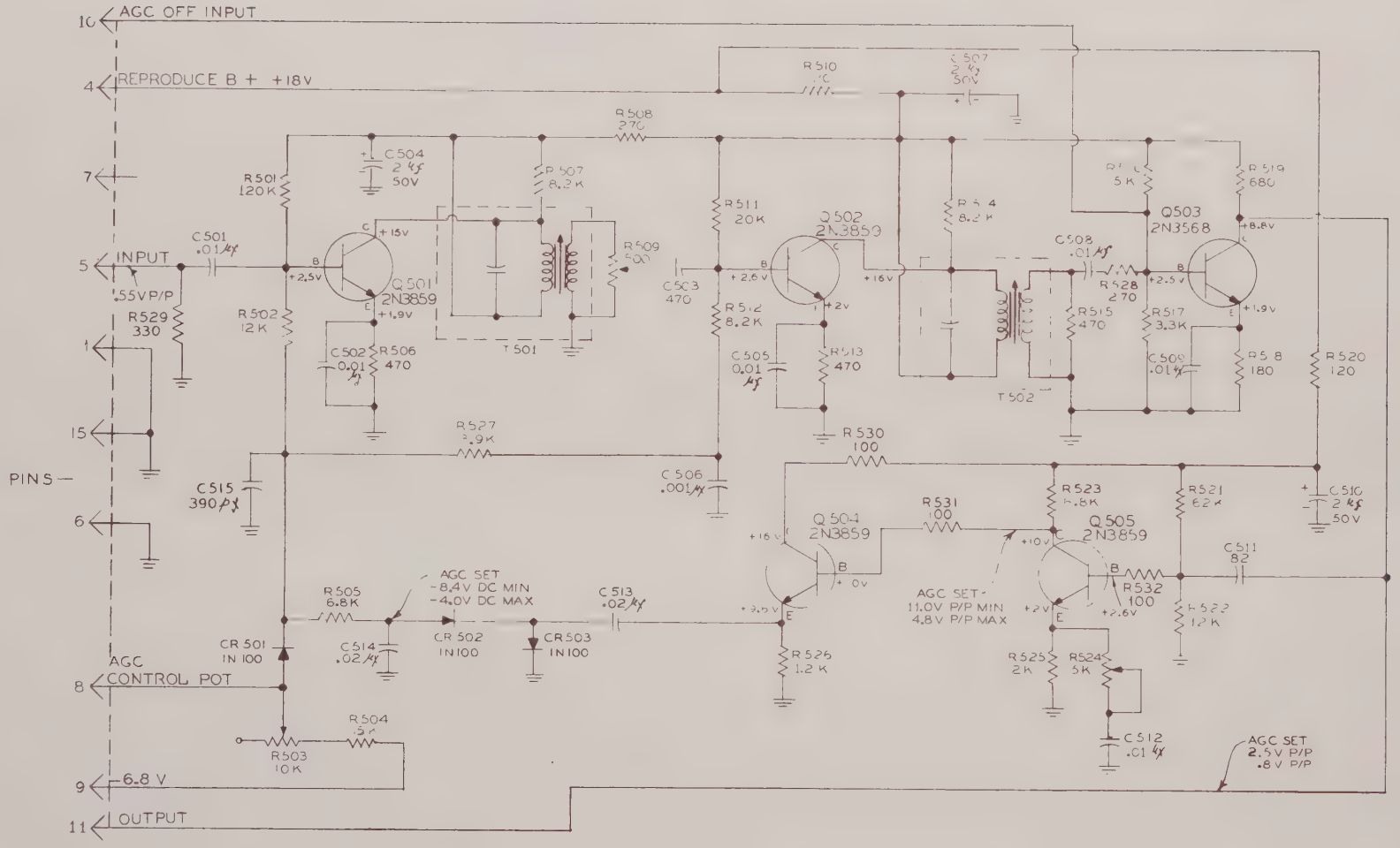
NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/2 W
ALL CAPACITANCES ARE IN pf

DWG. NO. B8994 E MONITOR + VU AMPL. - BOARD #3



NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/2W
ALL CAPACITANCES ARE IN µf
* FACTORY SELECT
Q401, Q404, Q405 WERE TI-495

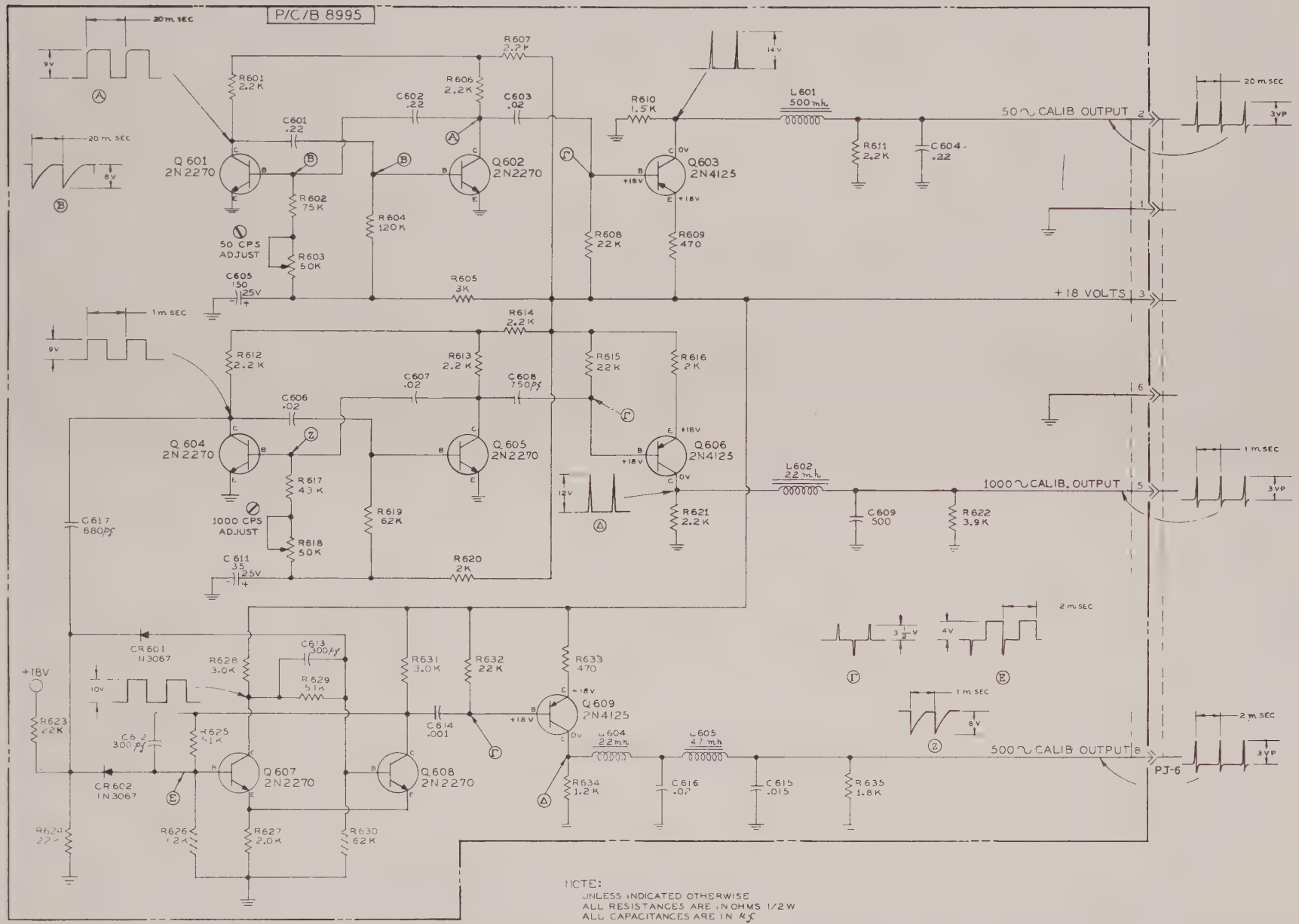
DWG. NO. B7759 M CARRIER OSC. + MOD - BOARD #4



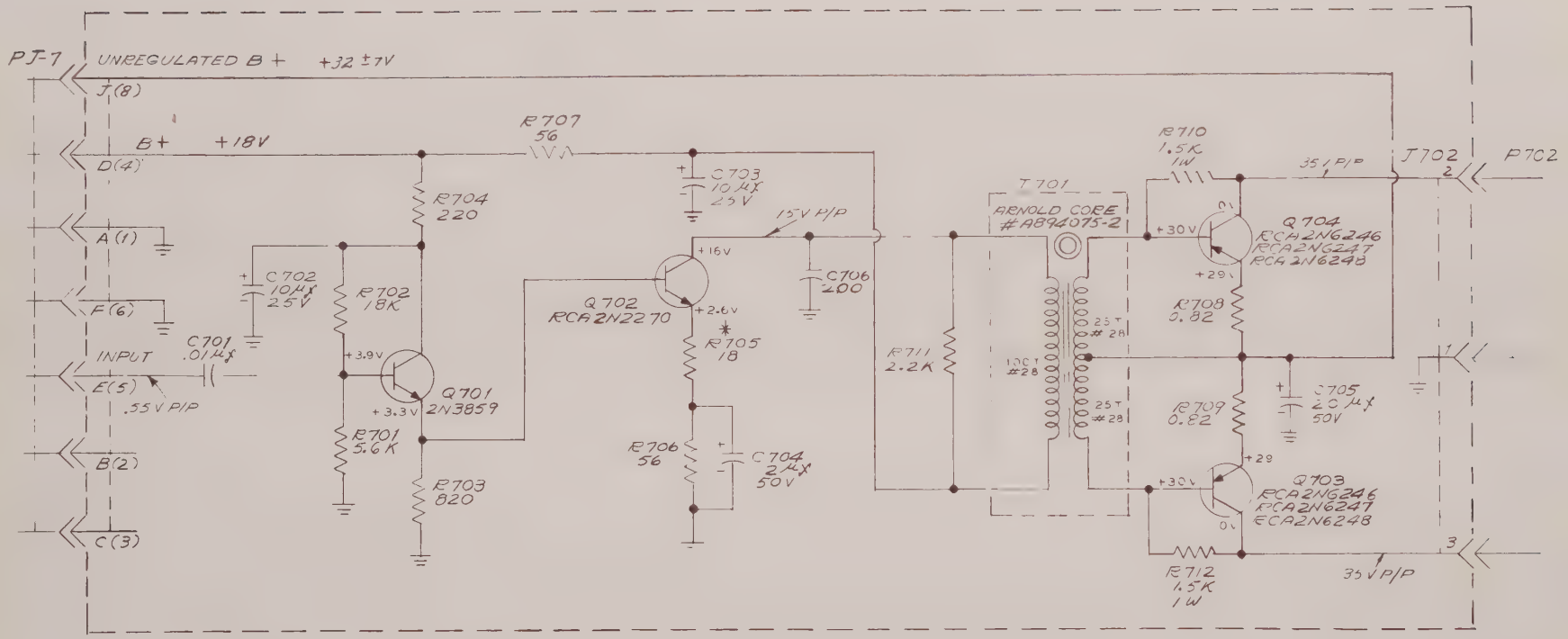
NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/2 W
ALL CAPACITANCES ARE IN µf
*FACTORY SELECT

Q501, Q502, Q505 WERE TI 495
Q504 WAS TI-494

DWG. NO. B7760 G AGC + IF AMPLIFIER - BOARD #5



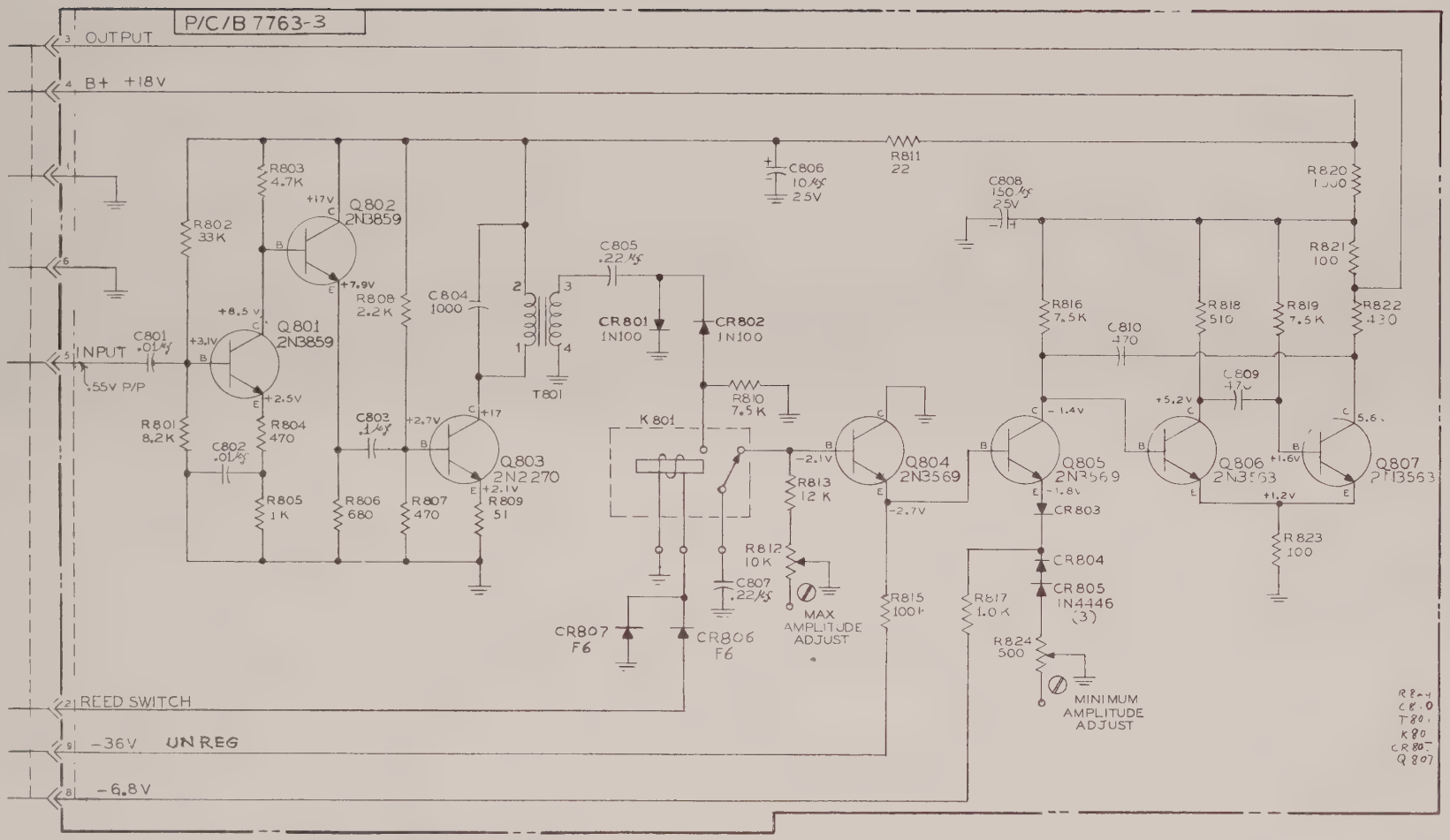
DWG. C8995 D CALIBRATE - BOARD #6



NOTE : UNLESS INDICATED OTHERWISE
ALL RESISTORS ARE IN OHMS, 1/2W
ALL CAPACITORS ARE IN μF
✳ INDICATES FACTORY SELECT

TYPICAL SIGNAL VOLTAGES ARE FOR OUTPUT STYLUS VOLTAGE OF 1200V P/P

DWG. NO. B7762 L MARK AMPLIFIER - BOARD #7

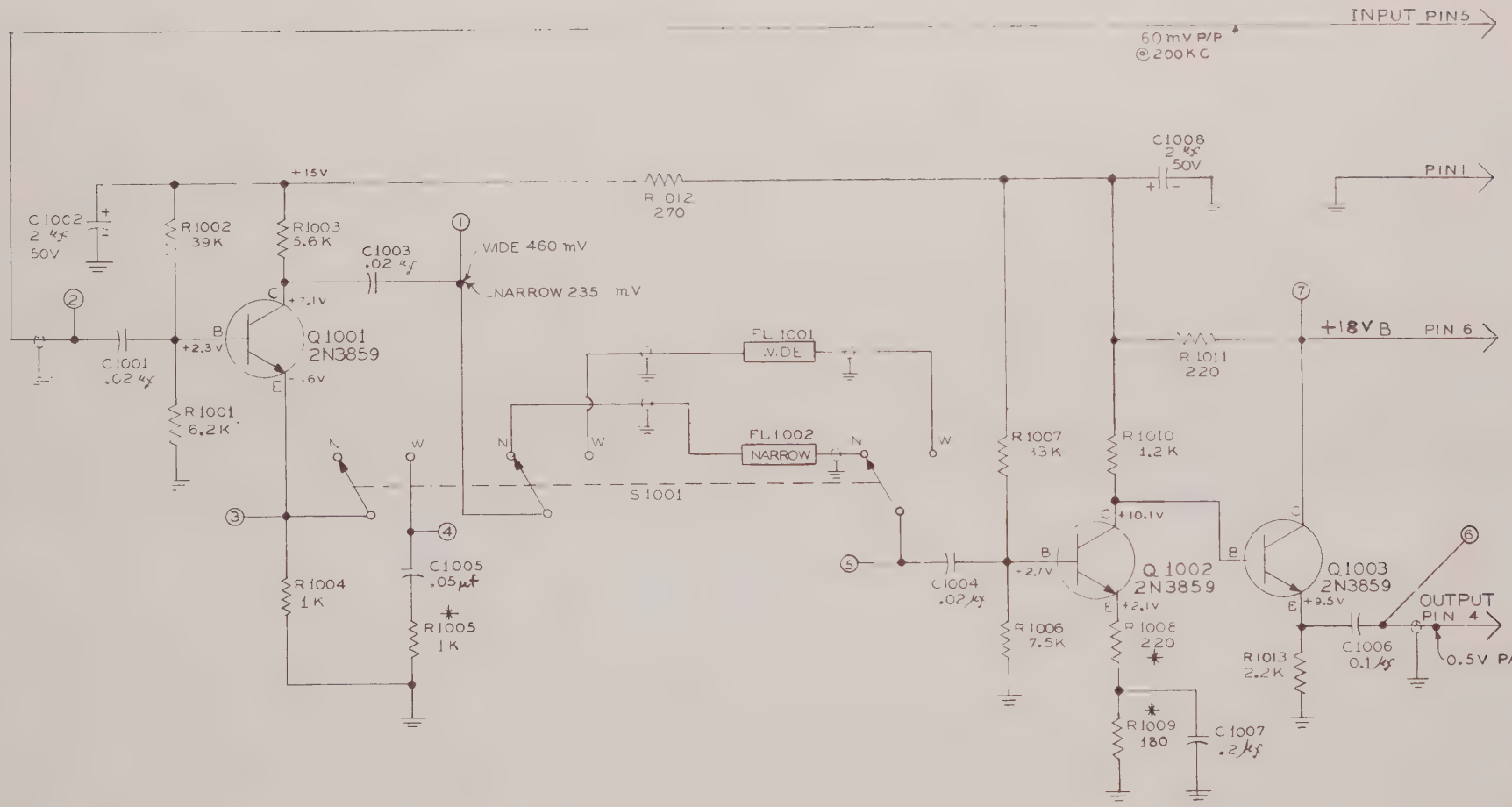


7030
7029A

NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/2W
ALL CAPACITANCES ARE IN μf

Q801, Q802 WERE: TI-494
Q804, Q805, Q806, Q807, WERE TI-495

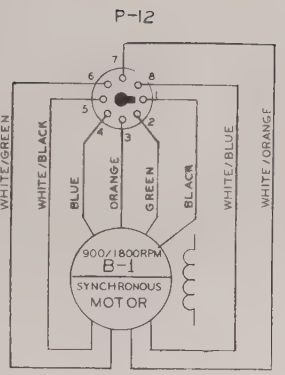
DWG. NO. B7763 K SECTIONER - BOARD #8

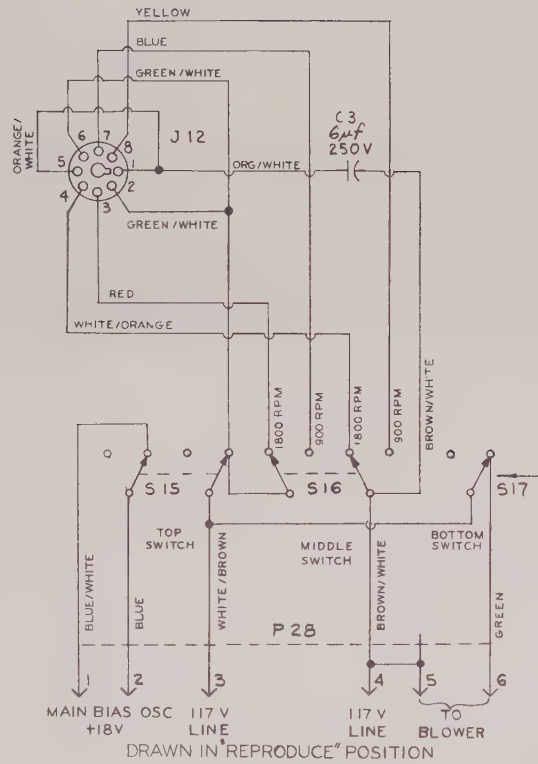


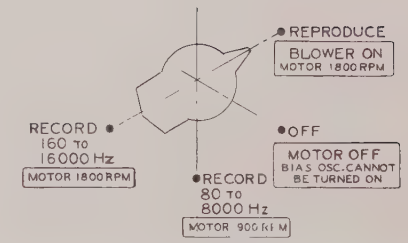
NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/4 W
ALL CAPACITANCES ARE IN µµf
* FACTORY SELECT
(4) THIS INDICATES EGRESS HOLES FOR WIRING

Q1001, Q1002 WERE TI-495
Q1003, WAS TI-494

DWG. NO. B8617 G FILTER





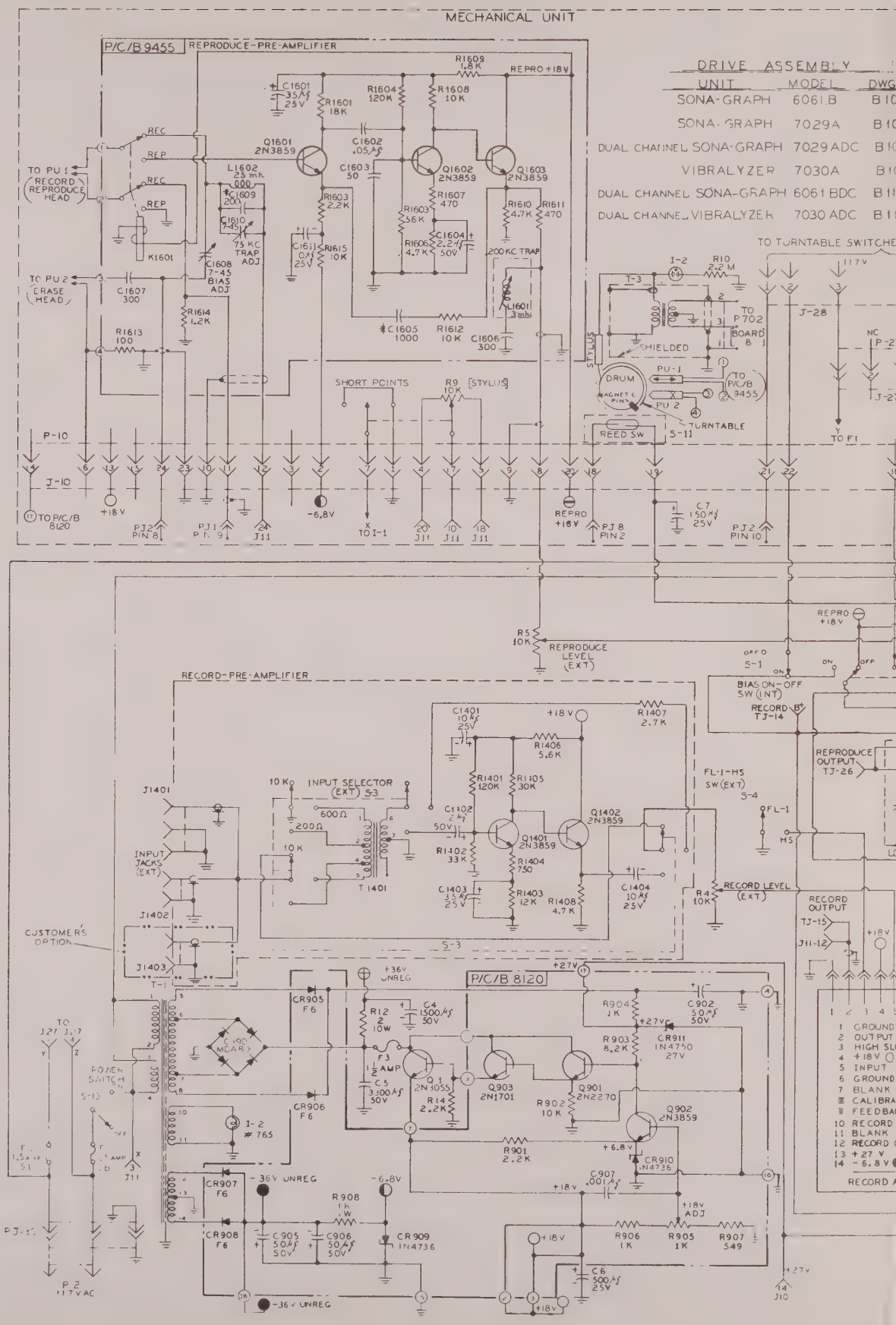


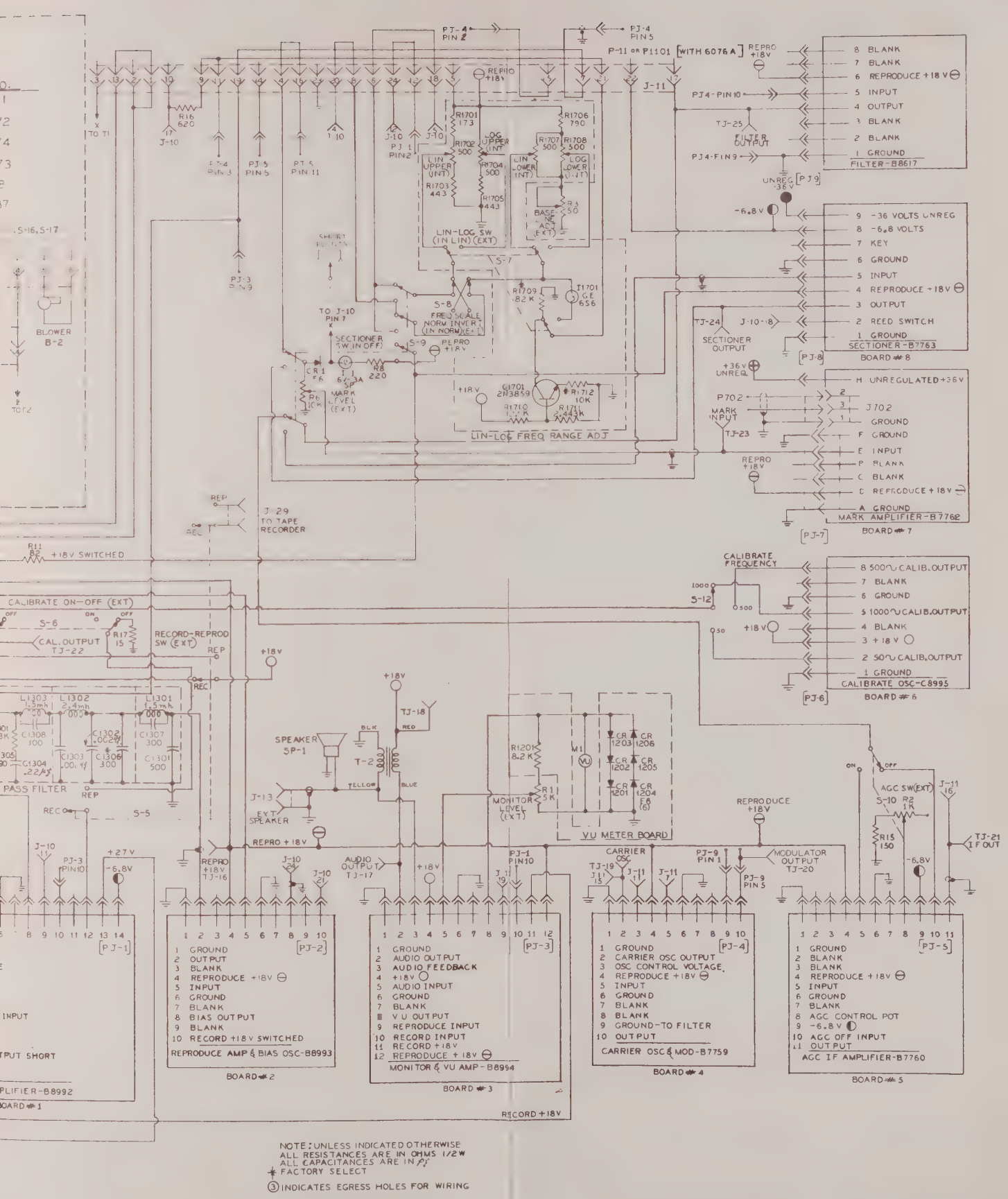
S-15, S-16, S-17
4-POSITION CAM OPERATED
TURNTABLE SWITCH
S-15, S-16 (2) STACKED DPDT MICROSWITCHES
S-17 (1) STACKED SPDT MICROSWITCH

REAR VIEW OF PLUG

TOP SWITCH S-15	RGT	LEFT	RIGHT	RIGHT
MIDDLE SWITCH S-16	LEFT	RGT	RIGHT	LEFT
BOTTOM SWITCH S-17	RGT	LEFT	LEFT	LEFT
TURNTABLE CONTROL	REPRO	OFF	RECORD 80-8000HZ	RECORD 160-16000HZ

DWG. NO. B10471 B 6061B DRIVE


MECHANICAL UNIT
P/C/B 9455
REPRODUCE-PRE-AMPLIFIER
DRIVE ASSEMBLY
UNIT
MODEL
SONA-GRAPH 6061.B
SONA-GRAPH 7029A
DUAL CHANNEL SONA-GRAPH 7029 ADC
VIBRALYZER 7030A
DUAL CHANNEL SONA-GRAPH 6061 BDC
DUAL CHANNEL VIBRALYZER 7030 ADC
TO TURNTABLE SWITCHE
REPRO +18V
REC
REP
TO PU 1
RECORD REPRODUCE HEAD
TO PU 2
ERASE HEAD
K1601
75 KC TRAP ADJ
BIAS ADJ
200KC TRAP
SHIELDED
STYLUS
DRUM
MAGNETIC PINS
PU-1
PU 2
TURNTABLE
REED SW
S-11
TO P/C/B 9455
TO P702 BOARD B 1
SHORT POINTS
R9 [STYLUS]
P-10
J-10
TO P/C/B 8120
+18 V
-6.8V
TO I-1
REPRO +18V
TO F1
REPRODUCE LEVEL (EXT)
RECORD-PRE-AMPLIFIER
INPUT SELECTOR (EXT) S-3
INPUT JACKS (EXT)
CUSTOMER'S OPTION
BIAS ON-OFF SW (INT)
RECORD TJ-14
REPRODUCE OUTPUT TJ-26
FL-1-HS SW (EXT) S-4
RECORD LEVEL (EXT)
RECORD OUTPUT TJ-15
P/C/B 8120
+36V UNREG
+27V
-36V UNREG
-6.8V
+18V
+18V ADJ
FOMEN SWITCH
TO J27 J-7
P2 117 VAC
RECORD A
1 GROUND
2 OUTPUT
3 HIGH SL
4 +18V
5 INPUT
6 GROUND
7 BLANK
8 CALIBRA
9 FEEDBA
10 RECORD
11 BLANK
12 RECORD
13 +27 V
14 -6.8 V



DWG. NO. D10,238 L 6061B + 7029A MAIN CHASSIS

SECTION V
OPTIONAL PLUG-INS

FIG. 5-1 Scale Magnifier-Amplitude Display
Plug-In 6076C

AMPLITUDE DISPLAY AND SCALE MAGNIFIER UNIT 6076-C

INTRODUCTION

This plug-in accessory for the Sona-Graphs performs two seperate functions. The AMPLITUDE DISPLAY function permits a display of the amplitude-vs-time on the upper third of the normal Sonagram. The SCALE MAGNIFIER function allows the expansion of any portion of the normal pattern to the full four inch width.

The 6076-C obtains its power from the Sona-Graph. No external cables or adapters are necessary. A front panel switch can be used to disable the 6076-C if normal operation of the Sona-Graph is desired. An attenuator is also included to reduce the overall amplitude of the pattern, when necessary, without resetting any other controls. The attenuator may be found useful if high-amplitude peaks extend beyond the upper SHORT POINT.

Installation is easily accomplished by removing the DUMMY plug-in supplied with the Sona-Graph and sliding in the 6076-C plug-in.

SPECIFICATIONS

Amplitude Display:

Height of amplitude-vs-time record, 1½ inch approx. Dynamic range, 24 db.

Scale Magnifier:

Range of Magnification, anywhere within the entire range of the Sona-Graph.

General:

Dimensions, 6 X 7 X 10 inches. Weight: 5.3 lbs.

OPERATING CONTROLS

CONTROLS	POSITION	FUNCTION
FUNCTION Switch (S-1101)	OFF	6076-C is completely bypassed.
	SCALE MAGNIFIER	SCALE MAGNIFIER function is energized.
	AMPLITUDE DISPLAY	AMPLITUDE DISPLAY function is energized.
10DB Pad (S-1103)		Provides 10 DB of attenuation to the input of the AMPLITUDE DISPLAY.
BASELINE Switch	ON (down)	Inserts a baseline on the paper, in place of the signal input, to be used as a referenced line for AMPLITUDE DISPLAY patterns.
UPPER LIMIT (R-1156)	Variable	When function switch is in the SCALE MAGNIFIER position, these controls determine the upper and lower limits of the magnification.
LOWER LIMIT (R-1156)	Variable	
ZERO ADJ.	Variable	Adjustment of baseline.
NORMAL-INVERT	Invert	Inverts the Sona-Gram Display.

A. SCALE MAGNIFIER

1.Place a fresh piece of Sonagram paper on the drum of the Sona-Graph.

2. Set the controls on the Sona-Graph as if a normal pattern were to be made.

3. Turn the selector on the 6076-C to the SCALE MAGNIFIER position. Set the LOWER LIMIT control for 000 and the UPPER LIMIT control for 000.

4. Raise the stylus until the SHORT POINT indicator goes out; then partially engage it.

5. Set the AGC control (on the Sona-Graph) to minimum, the MARK LEVEL control to (4), and the BAND SELECTOR to NARROW.

6. Turn the ZERO ADJ control until the BASELINE INDICATOR lights.

7. Now, adjust the UPPER and LOWER LIMIT controls for the desired frequency range. The calibration of these controls is only approximate.

8. Where precise measurements are involved, the calibration tone may be utilized.

9. Place the Mechanical Shift Lever in the REPROD position, set the MARK LEVEL and AGC controls as desired, and engage the stylus.

10. Return the stylus to the bottom of its travel when the pattern is complete.

B. AMPLITUDE DISPLAY

1. Set up the Sona-Graph as if a normal pattern were to be made.

2. Turn the selector switch on the 6076-C to the AMPLITUDE DISPLAY position.

3. Place the Mechanical Shift Lever in REPRODUCE, and adjust the REPRODUCE LEVEL control to obtain -2 on the VU meter.

4. Set the MARK LEVEL control to about (4).

5. Raise the stylus assembly to a point approximately one-third the way down from the top of the paper.

6. Depress the BASELINE switch and move the stylus up or down until the BASELINE INDICATOR lights. Then lower the stylus slightly, and, still holding down the BASELINE switch, engage the stylus.

7. As soon as the baseline has been marked on the paper, release the switch.

8. When the SHORT POINT indicator lights, return the stylus to its rest position.

9. If the pattern has gone off the upper limit of the paper, reduce the REPRODUCE LEVEL control or switch in the 10DB attenuator, engage the stylus slightly above the Amplitude Display baseline, and remark the paper.

CIRCUIT DESCRIPTION

Amplitude Display

When the Scale Magnifier-Amplitude Display selector is in the Amplitude Display position, the reproduce output of the Sona-Graph is connected to the input of this plug-in. This signal is then either fed directly to the base of Q-1101, or through a 10 db attenuator, as selected by a front panel control (normal/ -10db). The first stage, Q-1101, is utilized to set the overall minimum signal level (-24db input signal). The output of this stage is then passed to the base of Q-1102, a phase splitter. This stage has two outputs, the emitter circuit in phase, and the collector circuit 180 degrees out of phase with respect to the base signal. These two signals are used to drive the push-pull amplifier Q-1103 and Q-1104. A portion of the output of Q-1104 is then shaped by D-1101 thru D-1104 and fed back to the base of Q-1102. The outputs of the push-pull amplifier are then detected, filtered and used to operate the varactor diodes C-1124 and C-1125. These diodes in conjunction with Q-1105, Q-1106 and Q-1107 form a Wien-Bridge Oscillator circuit. As the voltage from the filter varies, the oscillator frequency will change between 67 and 96 KHz, depending upon the level of the input signal. Due to the feedback in the amplifier, the frequency of the oscillator will vary in such a manner as to produce a pattern that is linear in steps of db. When the Baseline switch is depressed, a short is placed on the base of Q-1101 thus eliminating all signals from passing through the amplifier. In this case, the oscillator is adjusted to produce an output frequency of 62 KHz.

Scale Magnifier

When the Scale Magnifier-Amplitude Display switch is in the Scale Magnifier position, the Upper and Lower Limit controls are placed at their respective ends of the stylus resistor, R-9. The wiper of this resistor is connected to the base of Q-1108. These voltages are then passed through the emitter follower and zener diode shaping network, D-1109 thru D-1111, which provide for the desired carrier oscillator frequency change with a corresponding change in position of the stylus control.

ALIGNMENT PROCEDURE

A. EQUIPMENT REQUIRED

Sona-Graph
Frequency Counter
DC VTVM, RCA Voltohmyst, or equiv.
AC VTVM
Audio Oscillator
Attenuator, 70 ohm, Kay Mod. 21-0, or equiv.

B. AMPLITUDE DISPLAY

Preliminary Settings:
Sona-Graph
ON-OFF switch—ON
SECTIONER—OFF
REC-REP switch—REP
RANGE switch—80Hz -8KHz
REC-OFF-REP switch—OFF
LIN-LOG switch—LIN
NORMAL INVERT switch—NORMAL

Plug-In Unit, 6076-C
S-1101—AMPLITUDE DISPLAY
NORMAL -10 DB switch—NORMAL

1. Connect the DC Voltmeter between ground and the junction of R-1115 and R-1121.
2 Adjust R-1168 for a reading of +44 volts. Remove meter.
3. Connect the counter to P-1101, pin 7 (AMPLITUDE DISPLAY output jack).
4. Depress the BASELINE switch and adjust R-1129 for a reading of 62 KHz.
5. Connect the attenuator between the output of the audio oscillator and the reproduce output jack.
6. Connect the AC VTVM to the REPRODUCE output jack.
7. Switch in 12 db of attenuation and adjust the output of the oscillator to obtain 85 mv.
8. Adjust R-1122 to obtain 81.6 KHz.
9. Insert 12 db more attenuation and adjust R-1157 to obtain 67.0 KHz.
10. Take out 24 db and adjust R-1160 for a reading of 96.2 KHz.
11. Output frequencies should track input levels as follows:

INPUT (DB)	OUTPUT (±500 Hz)
0	96.2 KHz
-4	91.34 KHz
-8	86.48 KHz
-12 (85mv) REF	81.6 KHz
-16	76.76 KHz
-20	71.90 KHz
-24	67.0 KHz

If necessary, repeat Steps 7, 8, and 9 to obtain above readings, utilizing R-1160 to split the error between 91.34 and 96.2 KHz, and R-1157 to split the error between 67.0 and 71.9 KHz. 76.76 and 86.48 KHz should track if the unit is properly aligned; do not readjust for these frequencies.

C. SCALE MAGNIFIER

Preliminary Settings:

Sona-Graph

- ON-OFF switch—ON
- SECTIONER—OFF
- REC-REP switch—REP
- RANGE switch—80Hz -8 KHz
- REC-OFF-REP switch—OFF
- LIN-LOG switch—LIN
- NORMAL-INVERT switch—NORMAL

6076-C Plug-In Unit

- NORMAL-INVERT switch—NORMAL
- S-1101—SCALE MANGIFIER
- R-1146—R-1153—FULLY CCW
- UPPER LIMIT control—000 (Fully CCW)
- LOWER LIMIT control—000 (Fully CW)
- ZERO ADJUST—1/3 turn from fully CW

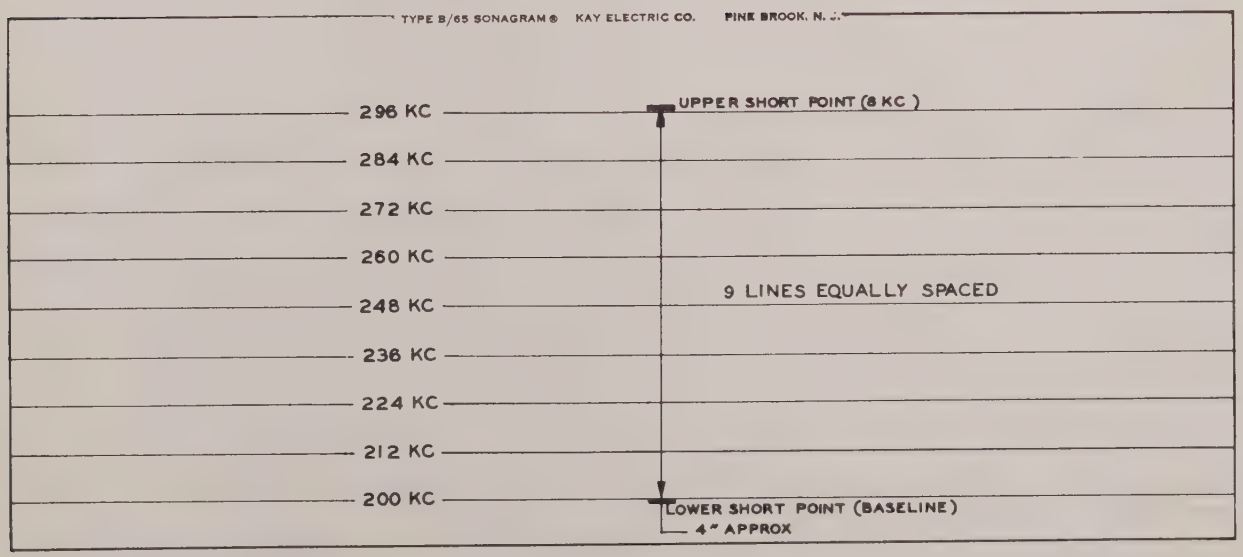


FIG. 5-2 TYPICAL CALIBRATION CHART

1. Connect a counter, in series with a 100 K resistor, to the CARRIER OSCILLATOR jack inside the 6061-B, and fasten the calibration chart (SEE Fig. 5-2) to the drum.
2. Set the stylus at the bottom of the lead screw, and then raise it to a point where the SHORT POINT indicator just goes out.
3. Slide the calibration chart up or down the drum until its lower short line is aligned with the stylus. Do not move the chart from this position for the remainder of this procedure.
4. Adjust R-1153 for 199.7 KHz on the counter.
5. Raise the stylus to the 2 KHz chart line, and adjust R-1146 for a 224 KHz reading.
6. Raise the stylus to the 4 KHz chart line, and adjust R-1148 for a 248 KHz reading.
7. Raise the stylus to the 6 KHz chart line, and adjust R-1150 for a 272 KHz reading.
8. Raise the stylus to the UPPER short point and lower it to a point where the SHORT POINT indicator just goes out. Adjust R-1152 for a 296.7 KHz reading.
9. Repeat the preceding steps, rechecking the frequency accuracy. Touch up the adjustments if necessary.

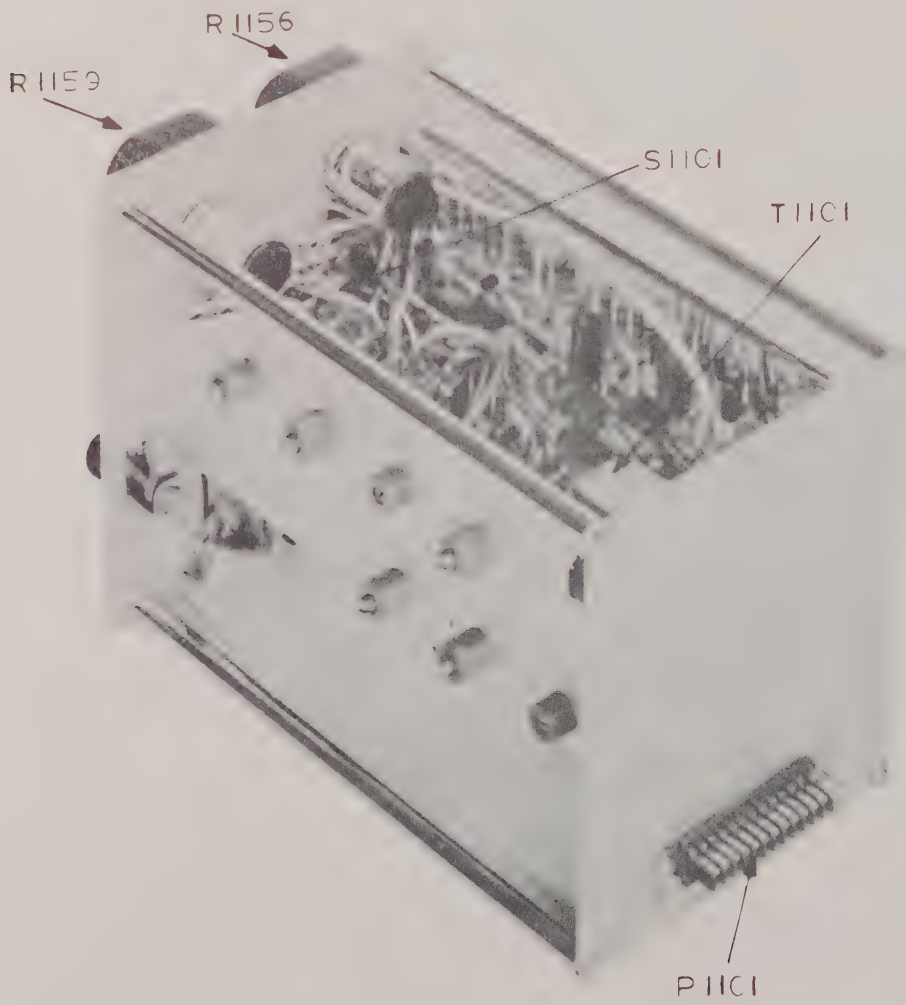


FIG. 5-3 6076-C, INTERNAL CONTROLS

FIG. 5-4 CONTOUR DISPLAY PLUG-IN
6070-A

CONTOUR DISPLAY UNIT
6070-A

INTRODUCTION

The 6070A CONTOUR DISPLAY PLUG-IN is compatible with KAY's solid state spectrum analyzers, the 6061A, 6061B, 7029A and the 7030A. This compact unit accepts the amplitude modulated IF signals of the spectrum analyzer and converts them into clearly defined contour lines at 6 db intervals. This allows for easy interpretation of the amplitude characteristics of the signal being analyzed. Variations in the contour line width allow the operator to distinguish the ascending from the descending signal strengths.

Separate front panel controls allow the operator to select the most desirable contour line and contour shading intensities, providing a more meaningful interpretation of the parameters being studied. A front panel terminal allows interconnection of the 6076C plug-in for 0 to 100% expansion of the contour display.

INSTALLATION

Unpacking: After removal of packing cases and protective paper wrapping, the equipment should be checked for physical damage. Then check the packing case to insure the removal of all items shipped. Any shortage should be reported to the carrier and Kay Elemetrics Corp.

To install the 6070A, remove the plug-in installed, and slide the 6070A into the receiving well ascertaining that the plug-jack combination is mated properly. Turn the pawl fastener knobs, located on the plug-in front panel, in a clockwise direction until the 6070A is locked in the main unit.

To install the 6076C plug-in when using the CONTOUR DISPLAY, first install the 6070A as indicated above; then install the accessory cable between the front panel terminal on the 6070A and the rear connector on the 6076C.

SPECIFICATIONS

FREQUENCY RANGE:	5Hz-16KHz (depending on the Sona-Graph in use).
DYNAMIC RANGE:	42 db
CONTOUR LINE SPACING	6 db.
CONTOUR SPACING ACCURACY:	+0.25 db

INTRODUCTION

The operating procedures described in this manual concern only the functions of the Contour Display Unit. References made to the basic Sona-Graph unit are contained in the manual provided with that unit and reference to this information will be helpful in providing the operator with a more complete knowledge of the unit and its function.

OPERATING CONTROLS AND FEATURES

CONTROL	POSITION	FUNCTION
ON-OFF Switch (S-1)	OFF	Disables the 6070A allowing a normal Sonagram to be produced.
	ON	Energizes the power supply circuits of the 6070A.
CONTOUR INTENSITY (R-130)	Variable	Controls darkness of contour outlines.
CONTOUR SHADING (R-136)	Variable	Controls darkness of shaded areas between outlines.
MAXIMUM LEVEL INDICATOR (I-1)		Indicates maximum signal level contour display will analyze without overloading.
B+ ADJ (R-143)	Variable	Adjustment for setting the +52 V supply.
B- ADJ (R-152)	Variable	Adjustment for setting the -30 V supply.
ZERO ADJ (R-23)	Variable	Control for setting base bias of Q6 to 0 volts when no signal is present.
6076 CONNECTOR (P-7)		Allows interconnection of the 6076 for expansion of the contour pattern.

A. Install the plug-in as described on page 5-7.
B. Record the desired information as outlined in the Sona-Graph Operating Instructions.

C. Place the BAND SELECTOR switch on the Sona-Graph to the WIDE position.
D. Place the ON-OFF switch on the 6070A in the ON position.
E. Place the Sona-Graph drive in the REProduce position and adjust the REPRODUCE LEVEL control for a reading of -3 on the VU meter.
F. To set the MAXIMUM LEVEL INDICATOR slowly raise and lower the stylus and adjust the REPRODUCE LEVEL control on the Sona-Graph until the neon indicator just lights at one or two points along the travel of the stylus.

NOTE: Do not lower the stylus into the baseline area while making this adjustment. (Keep the stylus at least ½" above lower short point).

G. Set the CONTOUR LINE INTENSITY control for the desired pattern darkness.
H. Adjust the CONTOUR SHADING INTENSITY control so that the different signal levels are clearly defined. With the control set too high, there will not be any distinction between the sixth and seventh levels. With the control set too low, the first and second levels will be white.
I. Scale Magnifier Operation: When the 6076B is used with the Contour Display plug-in unit, interconnect the units as described in Installation of this manual and follow the procedure outlined above.

CIRCUIT DESCRIPTION

An amplitude modulated IF signal from the Sona-Graph is applied to the base of phase splitter Q-1. The collector output of Q-1 is passed to emitter follower Q-2 providing a low impedance output to Q-4, the one stage of push-pull amplifier Q-3 and Q-4. The emitter output of Q-1 provides a signal of opposite phase from the collector signal. This emitter signal is fed to emitter follower Q-34 that provides the low impedance drive for Q-3. The resulting amplified 200 KHz output is transformer coupled from the collectors of Q-3 and Q-4 to a negative voltage detector, D1 and D2. Emitter follower, Q-5, provides the proper match for the low-pass filter C11, L1 and C12, which rejects signals above 300 Hz. Maximum level indicator, I-1 monitors the signal lever being introduced to the step function generator and indicates the maximum signal level at which the step function generator will process information without overloading.

The emitter output of Q-6 is passed through the differential amplifiers Q-7, Q-8, and Q-10, Q-11. Q-9 is used as a current source to maintain a constant current through Q-10. Emitter followers Q-12 and Q-13 provide a low impedance output to drive the step shaping network, D3 through D16. With zero volts on the base of Q-6, D16 will be conducting, thus providing a feedback path thru R68 to maintain the overall amplifier gain at unity. As the voltage on the base of Q-6 increases, a point is reached where D16 stops conducting thereby eliminating the feedback. This causes the output to jump to a higher level until D14 and D15 conduct, restoring the feedback. This process continues progressively, so that with a constant increase in input, seven steps are generated. In a like manner, decreases in the signal level will cause similar, but inverted steps. Each jump in the output represents an input change of 6db. The entire ramp waveform is then passed to the pulse generator and the contour shading network.

The ramp waveform from the step function generator is passed through trap L-3 and C-33 to reject any 200 KHz signals which might otherwise feed through and sporadically fire the pulse generator. The positive jumps (ascending in amplitude) and the negative jumps (descending in amplitude) are differentiated and the resulting triggers are amplified and inverted by Q-17. The negative going spikes, representing the ascending contour lines, are then inverted by Q18 and the bottom portion of the spikes is clipped by D23. D23 also prevents an improper polarity trigger from passing the inverter. The resultant spikes obtained from these two clipped devices are then utilized to trigger monostable multivibrators Q19-20 and Q-21-22 respectively. The output of these stages is a series of precisely timed pulses which is present at the base of Q23.

Transistors Q-24 and Q-25 form a 200 KHz free running multivibrator. One of the outputs of the multivibrator is controlled by Q-23. Q-23 is normally in a position that shorts the 200 KHz signal to ground. When its base is triggered by a timing pulse from either Q19-20 or Q21-22, the short is removed and the 200 KHz signal is allowed to pass. Thus when either jump occurs, (ascending or descending) they will produce a burst of 200 KHz signal to produce the contour outlines. One will notice that due to the difference in time constants of the two multivibrators, the ascending contour outline is narrower than the descending contour outline.

At the same time, the DC ramp is fed through an emitter follower Q-14 in the contour shading network. Diodes D17 through D22 are arranged to fire in order as each new step voltage is introduced to the network. A portion of the 200 KHz multivibrator output is present at the base of Q-15. Each diode network, when energized, causes an impedance change in the emitter circuit of Q-15. Each network, therefore, changes the emitter resistance, thus controlling the stage gain.

Both the pulsed output and the shading output are mixed together and are amplified by Q-16 and are then passed to the mark amplifier in the Sona-Graph.

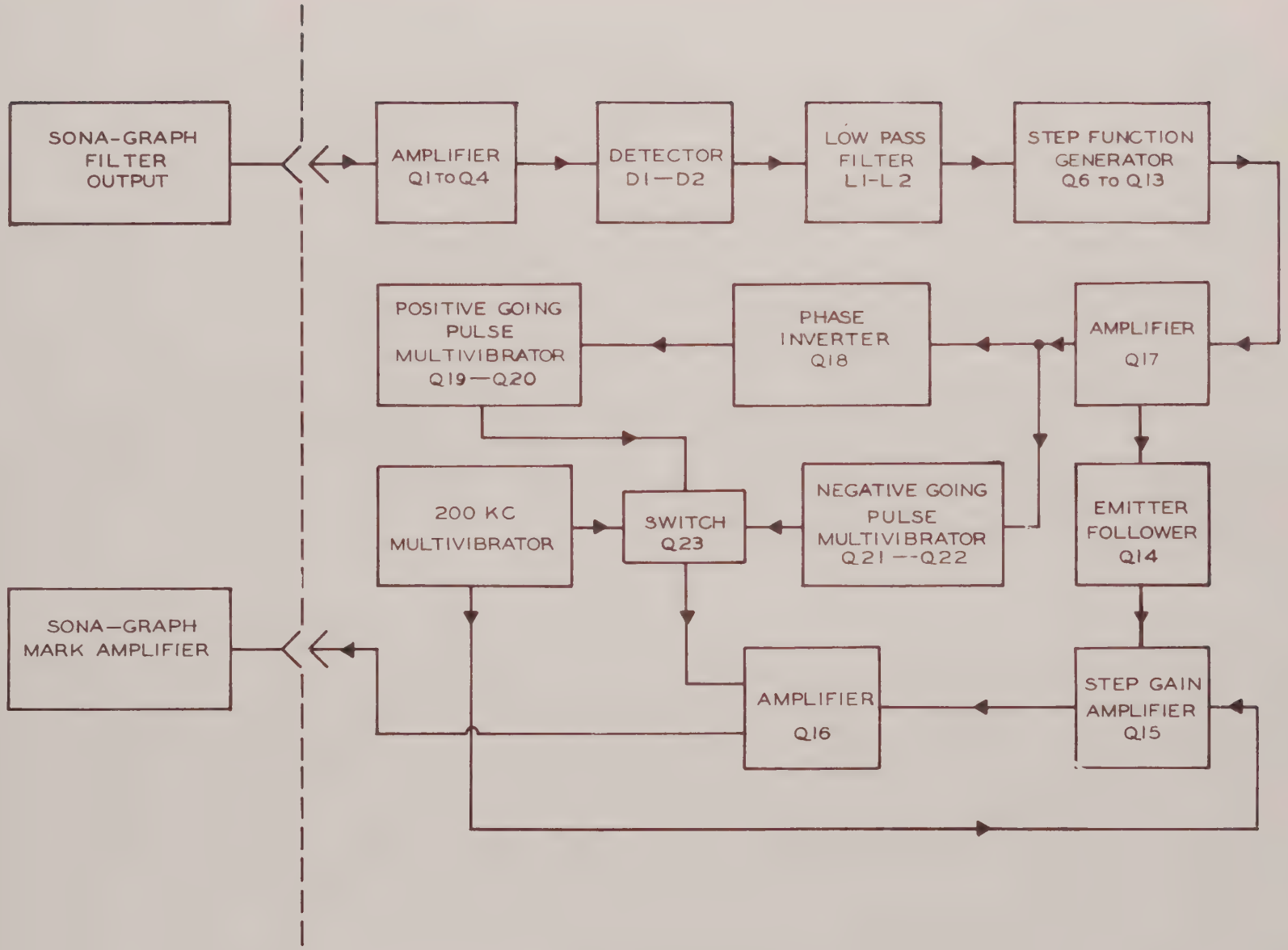


FIG. 5-5 FUNCTIONAL BLOCK DIAGRAM

ALIGNMENT PROCEDURE

APPLICATION

The following procedure will be useful when a factory-type set up of the unit is to be performed. The information will be helpful whenever repairs have been made or during maintenance periods.

ALIGNMENT PROCEDURE

Equipment Required:

VTVM - RCA or Equivalent
Oscilloscope - Tektronix 503 or Equivalent
Differential D.C. Voltmeter - Fluke or Equivalent

A. To perform this alingment it is necessary to slide the Sona-Graph main chassis out of the cabinet. This will expose the Contour Display Unit. Note the three test points on the rear of the 6070A, labeled: TP, +52V, and -30V.
B. Turn both units ON.
C. Connect the D.C. voltmeter (Fluke) to the +52V test point. Adjust R-143 for +52V, +.1V.
D. Connect the D.C. voltmeter (Fluke) to the -30V test point. Adjust R-152 for -30V, +0.1V.
E. Slide the Sona-Graph stylus assembly half way up and lock in place. Make sure that the MARK LEVEL control is set at 0. Connect the VTVM to the TP test point and adjust R-23 for a reading of +0.3 volts, +0.05 volts. It is advisable to recheck this setting after the unit has warmed up.
F. Return the Sona-Graph stylus to its normal position and record the test phrase "DID YOU THANK HIM".
G. Set both the CONTOUR LINE and CONTOUR INTENSITY pots to 5.
H. Set the MARK LEVEL to 3.
I. Place the Sona-Graph in REProduce.
J. Slowly raise and lower the stylus. Adjust the REProduce LEVEL POT UNTIL THE MAXIMUM LEVEL INDICATOR just lights.

NOTE: Do not lower the stylus into the baseline while making this adjustment. Keep the stylus at least ½" above the short point.

K. Produce a normal contour pattern.
L. Things to look for:
1. First contour area should be white.
2. Each level clearly distinguishable.
3. Check that shading and contour line correspond for each level.
4. Ascertain that seven levels are present.

M. The CONTOUR SHADING and REPRODUCE LEVEL may have to be changed slightly to meet all the above checks.

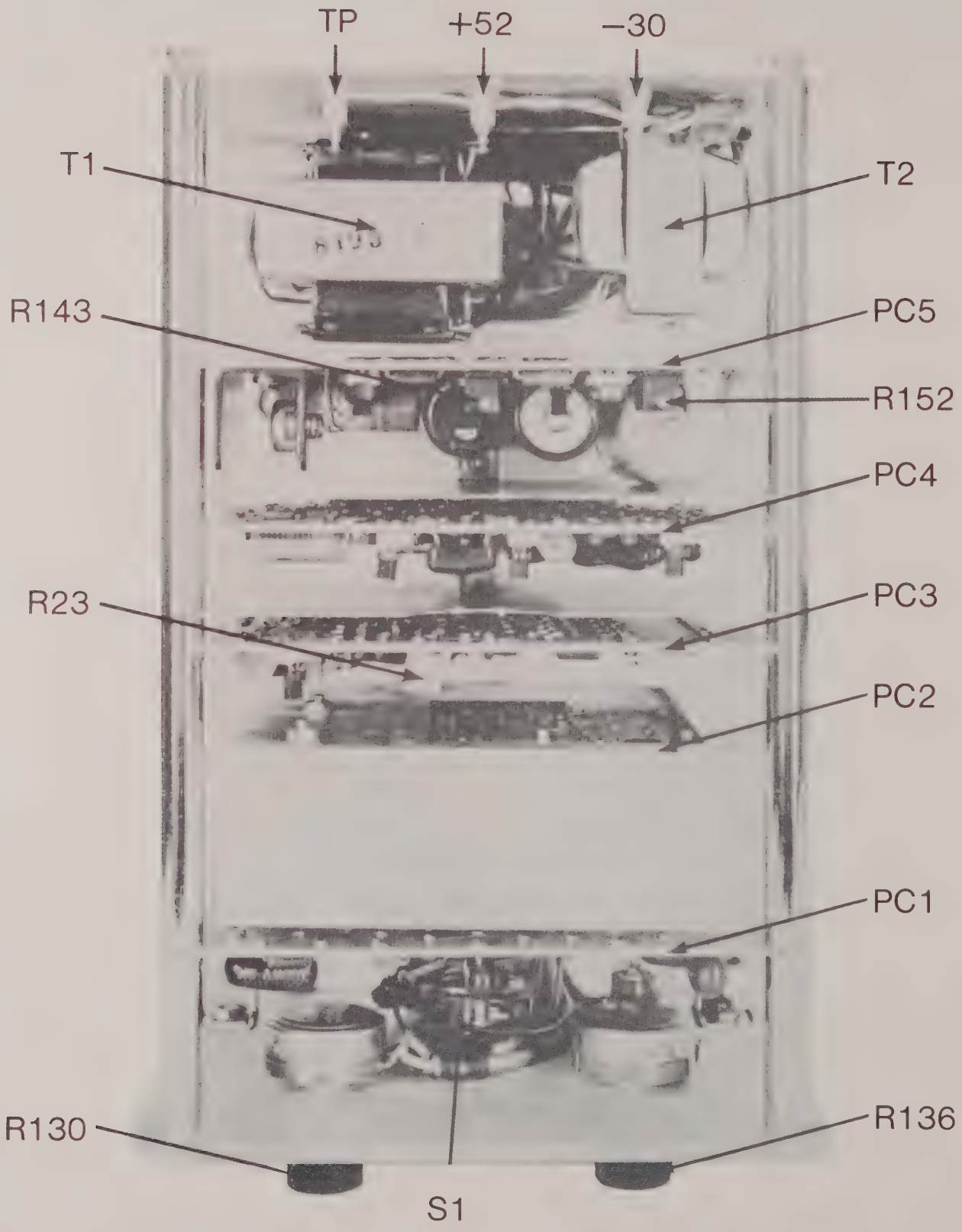


FIG. 5-6 6070A, TOP VIEW SHOWING MAJOR COMPONENTS

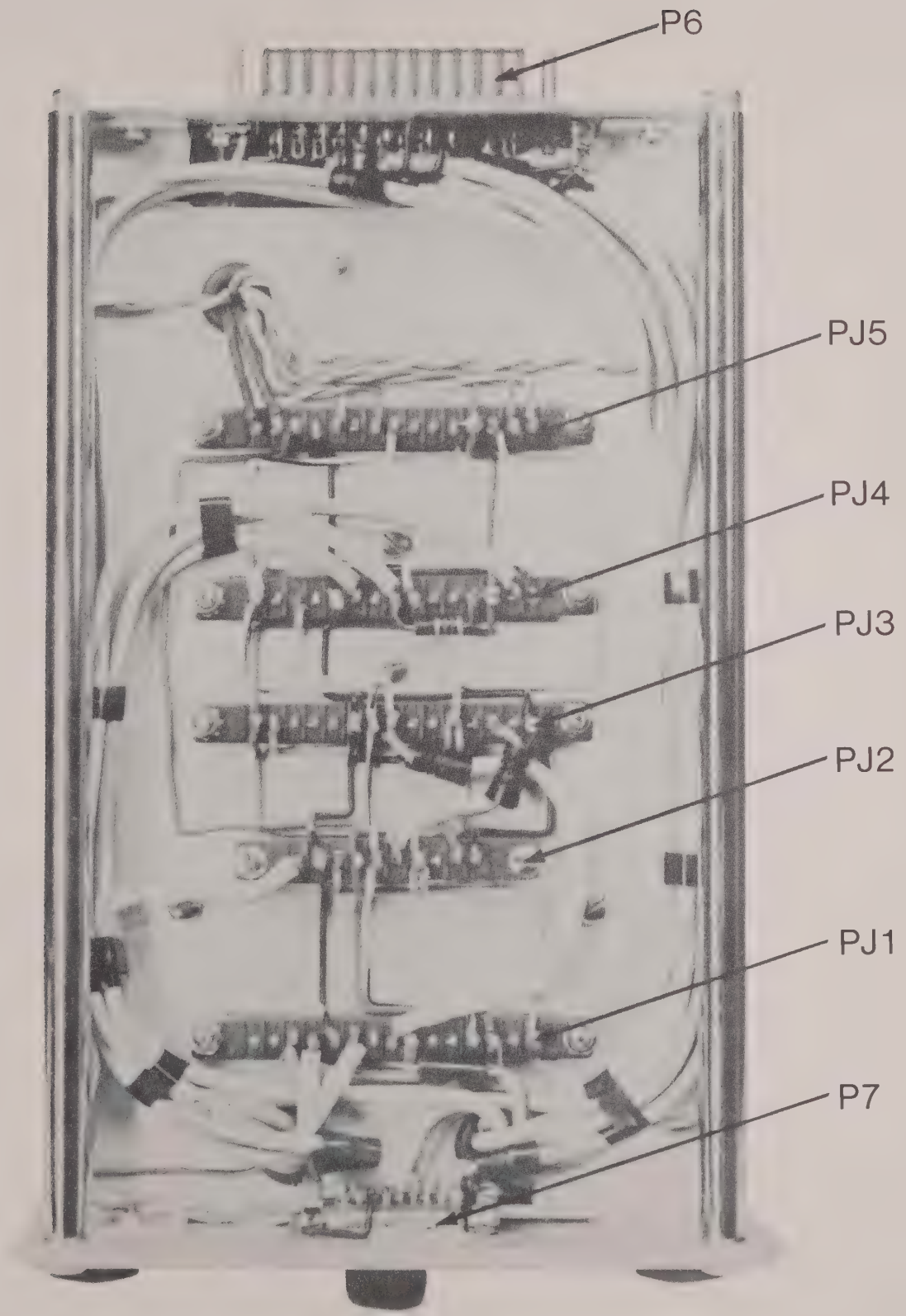
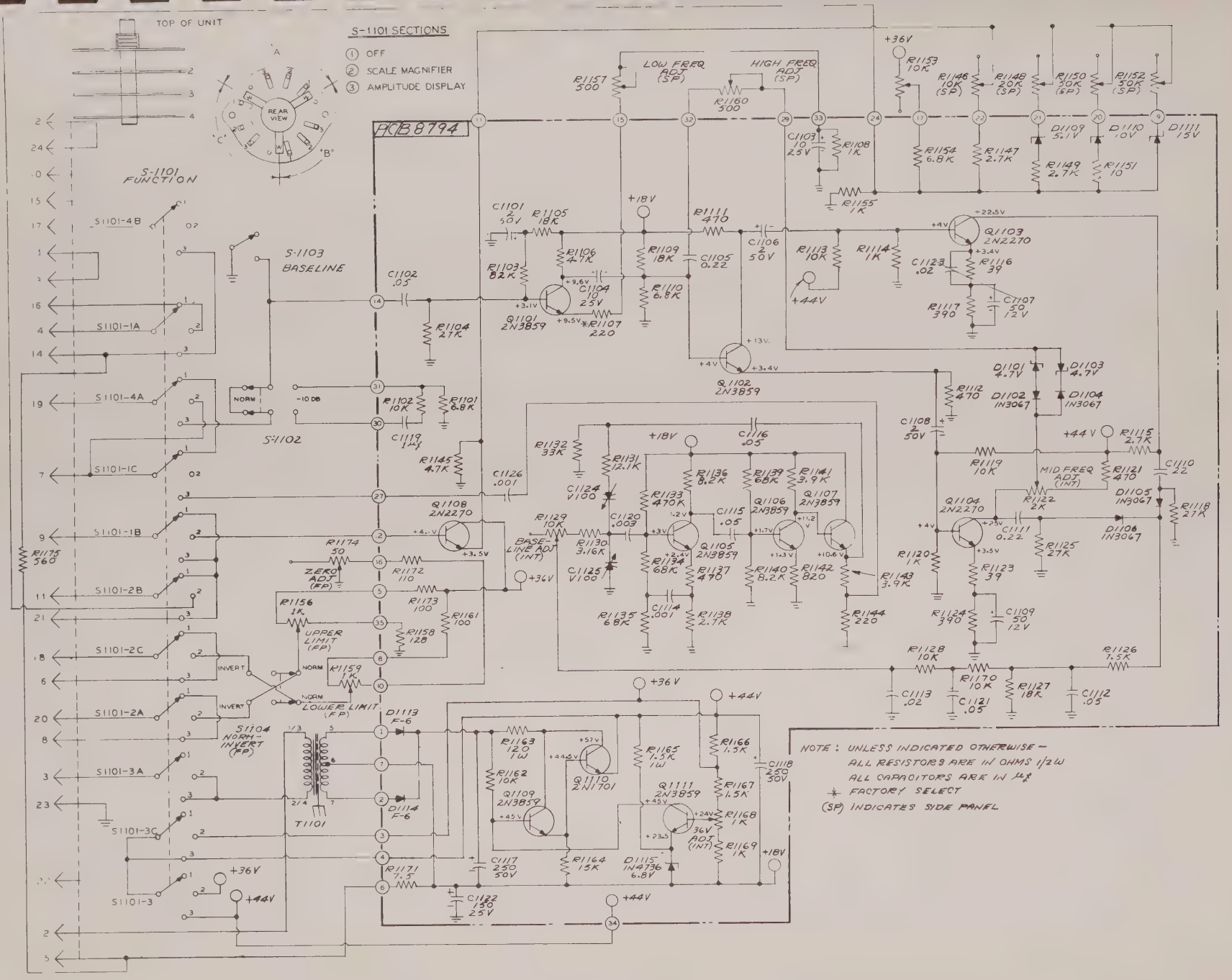
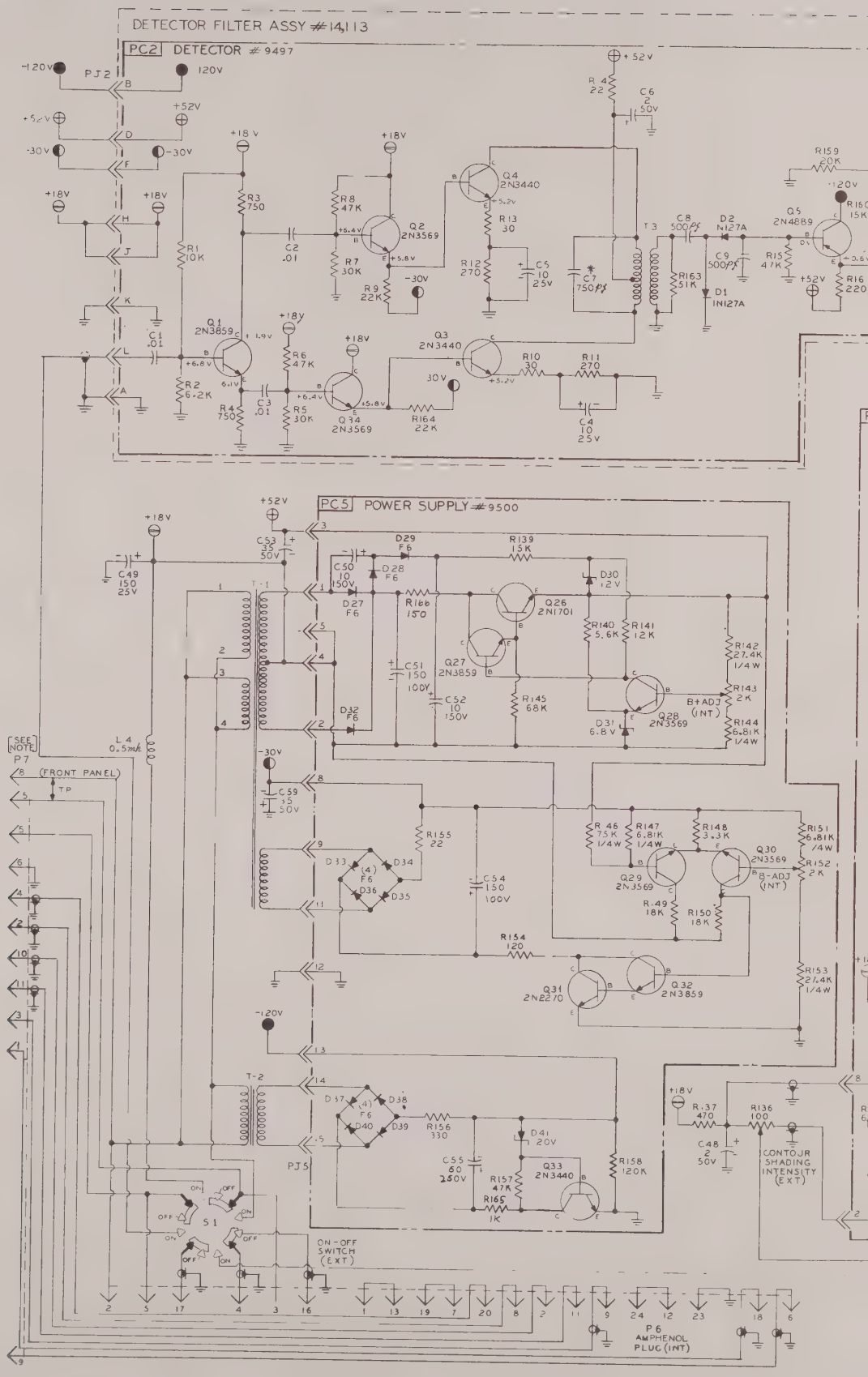
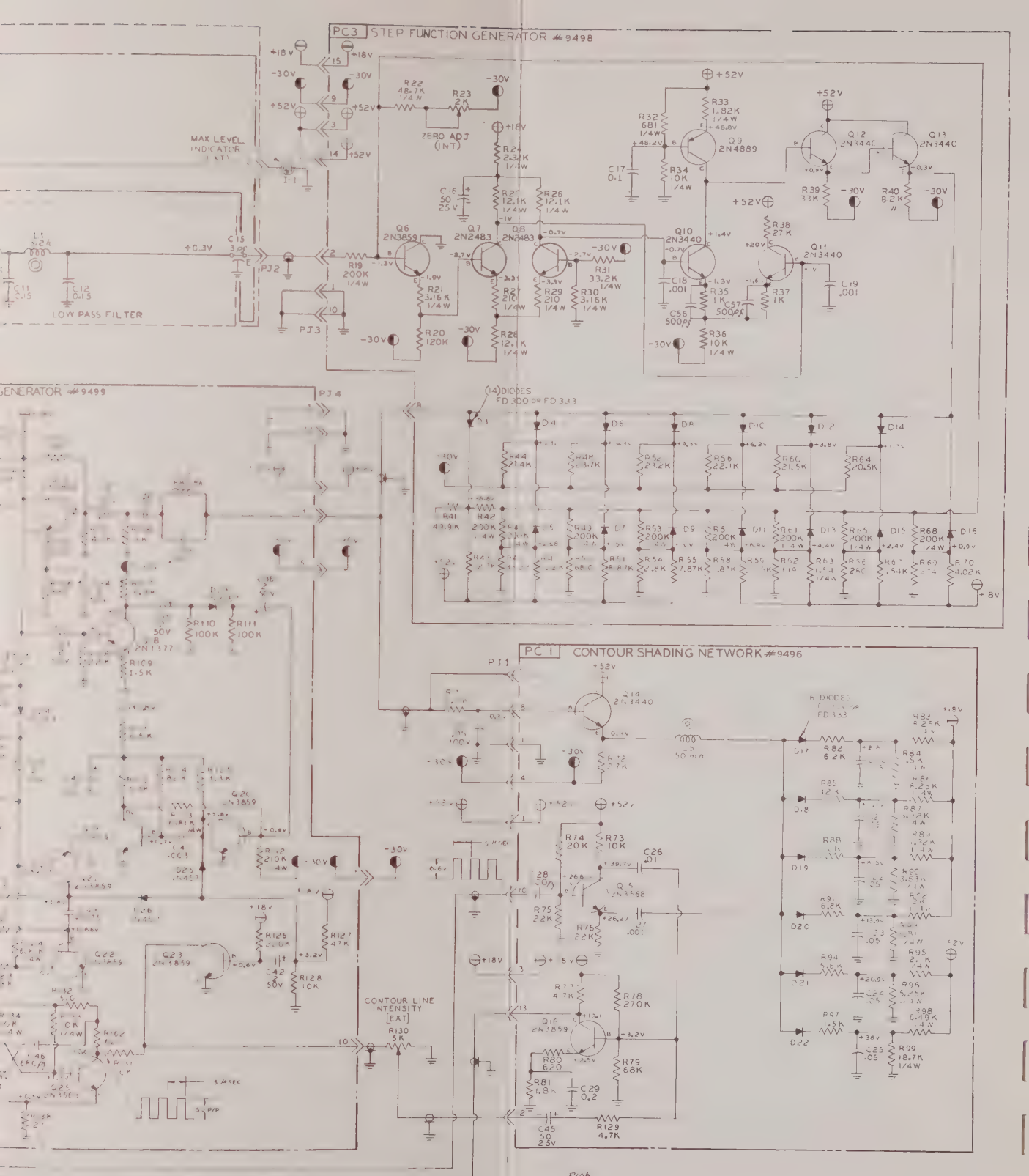


FIG. 5-7 6070A, BOTTOM VIEW SHOWING MAJOR COMPONENTS



DWG. NO. C9532 E SCALE MAGNITUDE + AMPLITUDE DISPLAY 6076C


DETECTOR FILTER ASSY #14,113
PC2 DETECTOR #9497
PJ2
-120V
120V
+52V
-30V
+18V
R1 10K
R2 6.2K
R3 750
R4 750
R5 30K
R6 47K
R7 30K
R8 47K
R9 22K
R10 30
R11 270
R12 270
R13 30
R15 4.7K
R16 220
R159 20K
R160 15K
R163 51K
R164 22K
C1 .01
C2 .01
C3 .01
C4 10 25V
C5 10 25V
C6 2 50V
C7 750pf
C8 500pf
C9 500pf
Q1 2N3859
Q2 2N3569
Q3 2N3440
Q4 2N3440
Q5 2N4889
T3
D1 1N127A
D2 N127A
PC5 POWER SUPPLY #9500
C49 150 25V
C50 10 150V
C51 150 100V
C52 10 150V
C53 35 50V
C54 150 100V
C59 35 50V
D27 F6
D28 F6
D29 F6
D30 12V
D31 6.8V
D32 F6
D33 (4) F6
D34
D35
D36
D37 (4) F6
D38
D39
D40
D41 20V
R139 15K
R140 5.6K
R141 12K
R142 27.4K 1/4W
R143 2K
R144 6.81K 1/4W
R145 68K
R146 7.5K 1/4W
R147 6.81K 1/4W
R148 3.3K
R149 18K
R150 18K
R151 6.81K 1/4W
R152 2K
R153 27.4K 1/4W
R154 120
R155 22
R156 330
R157 47K
R158 120K
R165 1K
R166 150
R137 470
R136 100
C48 2 50V
Q26 2N1701
Q27 2N3859
Q28 2N3569
Q29 2N3569
Q30 2N3569
Q31 2N2270
Q32 2N3859
Q33 2N3440
B+ADJ (INT)
B-ADJ (INT)
CONTOUR SHADING INTENSITY (EXT)
T-1
T-2
L4 0.5mh
SEE NOTE
P7
FRONT PANEL
TP
PJ5
S1
ON-OFF SWITCH (EXT)
P6 AMPHENOL PLUG (INT)



* INDICATES FACTORY SELECT

NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/2 W
ALL CAPACITANCES IN μF
WHEN 6070A IS OPERATED WITHOUT 6076A
PINS 1 & 15; 2 & 4; 3, 10, & 11 OF PLUG 7
ARE CONNECTED USING AMPHENOL JUMPER
PLUG

B106
C61
D41
Q34
Z6

DWG. NO. D9491 P CONTOUR DISPLAY 6070A

PARTS LIST

SECTION 6

PARTS LIST

A ELECTRICAL -------- 6-2 THRU 6-12

B MECHANICAL -------- 6-13 THRU 6-32

C 6070A -------- 6-33 THRU 6-41

D 6076C -------- 6-42 THRU 6-45

PARTS LIST - MAIN CHASSIS AND PANEL, DWG. #D-10238-K

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
CAPACITORS:			
C4	1500 μf 50V., Electrolytic	6355-174	Mallory SP031-5119-235-7038K
C5	3300 μf 50V., Electrolytic	6355-191	Mallory CG332U50K1
C6	500 μf, 25V., Electrolytic	6355-148	Cornell Dubilier BR 500-25
CR1	Diode, F6, Silicon	6357-3	Sarkes Tarzian F6
F1 & F2	Fuse, 1.5 Amp S/B	6908-6	Bussman Mdl 1.5
F3	Fuse, 1.5 Amp 250V	6908-24	Bussman AGC 1.5
I1 & I2	Lamp 765, 6V	8644	Drake 765
JACKS:			
J1 thru J8	15 Contacts	6909-22	Amphenol 143-015-01
J9	8 Contacts	6909-2	Amphenol 26-183
J11	24 Contacts	6909-17	Amphenol 26-190-24
J13	Coax., UG625/U	6909-100	Specialty 28JR121-2
J29	2 Contacts	6909-43	Jones S 302AB
J30	AC Jack (male)	6909-23	Hubbel 7484
M1	Meter, VU	7863-A	Kay Elemetrics Corp.
PLUGS:			
P1 thru P6	Part of P.C. Board	---	---
P7	15 Contacts	6909-20	Amphenol 133-015-21
P8	Part of P.C. Board	---	---
P9	Part of Filter Assembly	---	---
P11	24 Contacts	6090-9	Amphenol 26-159-24
P12	AC Line Cord	7166-3	Belden 17405
P30	AC Plug (female)	4116	Hubbel 7486
Q1	Transistor, 2N 3055	K174	RCA 2N3055
RESISTORS: (Unless otherwise specified, all components are fixed composition, ½ watt, 10% tolerance)			
R1	5K, 1 watt pot	9122-152	Allen Bradley 70AYN0485502U
R2	1K, 2 watt pot, w/switch	9122-88	Allen Bradley JS2N048P102UE
R3	50μ, 2 watt pot	9122-168	Allen Bradley 70AYN0485500U
R4 & R5	Switch Assembly	13346	Kay Elemetrics Corp.
R6	10K, 1 watt pot	9122-157	Allen Bradley 70AYN0485103U
R8	220	2211-E	Allen Bradley EB2211
R11	82	8201-E	Allen Bradley EB8201
R12	2, 10 watt	9292-103	Ohmite 1705
R14	2.2K	2221-E	Allen Bradley EB2221
R15	150	1511-E	Allen Bradley EB1511
R16	620	6211-E	Allen Bradley EB6211
R17	15	1501-E	Allen Bradley EB1501
SWITCHES:			
S1	Toggle, SPST	6393-21	AH&H 21350 CF
S3	Rotary, 3 pos, 1 wafer	8589	Kay Elemetrics Corp.
S4	Rotary, 2 pos, 1 wafer	446-2	Kay Elemetrics Corp.
S5	Rotary, 2 pos, 1 wafer	176	Kay Elemetrics Corp.
S6	Lever, 2 pos, 6 CKT	6393-6	Mallory 1261612S
S7	Same as S5	------	------
S8	Toggle, DPDT	6393-11	AH&H 81027 CE
S9	Rotary, 2 pos, 2 wafer	445	Kay Elemetrics Corp.
S10	See Resistor R2		
S12	Rotary, Min 3 pos, 1 wafer	6393-7	Oak Mfg. 399-222A
S13	Same as S1		
Sp. 1	Speaker, 5" round	1003	Oxford Transducer Co. 5CM-S
T1	Transformer, Power	8988A	Kay Elemetrics Corp.
T2	Transformer, Audio Output	8518	Thordarson TR62

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
TJ14 thru TJ24	Test Jack, Black	8637	Alden 110 BCS1

PARTS LIST, RECORD AMPLIFIER BOARD, DWG. #B-8992-F

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
8992	P.C. Board Assembly #1	8992-W	Kay Elemetrics Corp.
CAPACITORS:			
C101	35μf 25V, Electrolytic	6355-150	GE 76F02KE350
C102 & C106	100μf 15V, Electrolytic	6355-141	GE 76F02FL101
C103	290μf 3 V, Electrolytic	6355-161	GE 76F02BK291
C104	.01μf 400V, Mylar paper	6899-8	Elmeneo 4DP-1-103
C105 & C107	2μf 50V, Electrolytic	6355-164	GE 76F02LC2R0
C108	100μf 6V, Electrolytic	6355-140	GE 76F02CF101
C109 & C113	390μf 500V, mica	6359-65	Elmenco DM 15-391
C110	50μf 500V, mica	6359-60	Elmenco DM 15-500
C111	7-45μμf, 500V, Electrolytic	6355-7	Erie 503000 D2P033R
C112	50μf, 25V, Electrolytic	6355-167	GE 76F02KF500
C114	20μf, 50V, Electrolytic	6355-189	GE 76F02LF200
C115	250μf, 6V, Electrolytic	6355-95	GE 76F02CL251
C116	.05μf, 100V, Mylar paper	6899-1	Elmenco 1DP-2-503
C117	68μμf, 500V, mica	6359-84	Elmenco DM15-680
L101	Coil, 10MH	7200	Toro Coil (Peter Crump)
Q101 thru Q105	Transistor, 2N 3859	K172	GE 2N3859

RESISTORS: (Unless otherwise specified, all components are fixed composition, ½ watt, 10% tolerance)

R101	120K	1241-E	Allen Bradley EB1241
R102	47K	4731-E	Allen Bradley EB4731
R103	3K 5% tol.	3025-E	Allen Bradley EB3025
R104	300 5% tol.	3015-E	Allen Bradley EB3015
R105	8.2K	8221-E	Allen Bradley EB8221
R106	510 5% tol.	5115-E	Allen Bradley EB5115
R107	5.6K	5621-E	Allen Bradley EB5621
R108 & R112 & R117	3.9K	3921-E	Allen Bradley EB3821
R109	820	8211-E	Allen Bradley EB8211
R110	47K	4731-E	Allen Bradley EB4731
R111	10K	1031-E	Allen Bradley EB1031
R113	2.2K	2221-E	Allen Bradley EB2221
R114	18K	1831-E	Allen Bradley EB1831
R115	10K	1031-E	Allen Bradley EB1031
R116	12K	1231-E	Allen Bradley EB1231
R118	6.2K 5% tol.	6225-E	Allen Bradley EB6225
R119	150	1511-E	Allen Bradley EB 1511
R120	270	2711-E	Allen Bradley EB2711
R121	22K	2231-E	Allen Bradley EB2231
R122	1K, ¼w	1021-C	Allen Bradley CB1021

PARTS LIST, REPRODUCE AMPLIFIER AND BIAS OSCILLATOR, DWG. #B-8993-G

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
8993	PC Board #2 Assembly	8993-W	Kay Elemetrics Corp.
CAPACITORS:			
C201 & C216 & C217	.02μf, 100V, Mylar paper	6899-13	Elmenco 1DP-1-203
C202	10μf, 25V, Electrolytic	6355-142	GE 76F02KD100
C203 & C208	68μf, 500V, Mica	6359-84	Elmenco DM15-680
C204 & C209	.01μf, 100V, Mylar paper	6899-12	Elmenco DM15-750
C205	75μf, 500V, Mica	6359-61	Elmenco DM15-750
C206 & C211 & *C213	.00μf, 600V, Mylar-paper	6899-10	Elmenco 6DP-1-102
C210	68μμf, 500V, Mica	6359-84	Elmenco DM15-680
C212	.01μf, 400V, Mylar paper	6899-8	Elmenco 4DP-1-103

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
C214	2μf, 50V, Electrolytic	6355-164	GE 76F02LC2R0
C215	35μf, 25V, Electrolytic	6355-150	GE 76F02KE350
*C218	.03μf, 100V, Mylar Paper	6899-22	Elmenco 1DP-1-303
C219	.15μμf, 50V, Mylar	6411-23	TRW 601PF
C220 & C221	.1μf, 100V, Mylar Paper	6899-11	Elmenco 1DP-2-104
L201	Coil, 250μh	6394-39	Miller 34300-250
Q201 thru Q204	Transistor, 2N3859	K172	GE 2N3859
Q205 & Q206	Transistor, 2N2270	K132	Motorola 2N2270

RESISTORS: (Unless otherwise specified, all components are fixed composition, ½ watt, 10% tolerance)

R201	150K	1541-E	Allen Bradley EB 1541
R202	30K	3035-E	Allen Bradley EB 3035
R203	1.8K	1821-E	Allen Bradley EB 1821
R204 & R209	10K	1031-E	Allen Bradley EB 1031
R205 & R210	30 K	3035-E	Allen Bradley EB 3035
R206	150K	1541-E	Allen Bradley EB 1541
R207	30K	3031-E	Allen Bradley EB 3031
R208	1.8K	1821-E	Allen Bradley EB 1821
R211	68K	6831-E	Allen Bradley EB 6831
R212	56K	5635-E	Allen Bradley EB 5635
R213	1.8K	1821-E	Allen Bradley EB 1821
R214	2.2K	2221-E	Allen Bradley EB 2221
R215	5.6K	5621-E	Allen Bradley EB 5621
R216	1K	1021-E	Allen Bradley EB 1021
R217 & R218	1.8K	1821-E	Allen Bradley EB 1821
R219	10, 2 watt	1001-H	Allen Bradley HB 1001
R220	330	3311-E	Allen Bradley EB 3311
R221	51	5105-E	Allen Bradley EB 5105
R222	10	1001-E	Allen Bradley EB 1001
T201	Transformer, special	8525-B	Kay Elemetrics Corp

NOTE:*= Factory selected, value shown are approx.

PARTS LIST - MONITOR AND VU AMPLIFIER, DWG. #B-8994-B

8944	PC Board #3 Assembly	8994-W	Kay Elemetrics Corp

CAPACITORS:

C301 & C303	180μμf, 500V, Mica	6359-74	Elmenco DM15-181
C302	300μμf, 500V, Mica	6359-64	Elmenco DM15-301
C304	7-45μμf, 500V, Ceramic	6358-7	Erie 503000D2P033R
C305 & C308 & C315	100μf, 6V, Electrolytic	6355-140	GE 762CF101
C306	.01μf, 400V, Mylar paper	6899-8	Elmenco 4DP-1-103
C307 & C314	10μf, 15V, Electrolytic	6355-131	GE 76F02FC100
C309	.002μf, 600V, Mylar paper	6899-4	Elmenco 4DP-1-103
C310	2μf, 50V, Electrolytic	6355-164	GE 76F02LC2R0
C311	.02μf, 100V, Mylar Paper	6899-13	Elmenco 1DP-1-203
C312	35μf, 25V, Electrolytic	6355-150	GE 76F02KE350
C313	2μf, 50V, Electrolytic	6355-164	GE 76F02LC2R0
C316	100μf, 500V, Mica	6359-46	Elmenco DM15-101
C317	100μf, 15V, Electrolytic	6355-141	GE 76F02FC101
C318	.001μf, 600V, Mylar paper	6899-10	Elmenco 6DP-1-102
C319 & C320	10μf, 25V, Electrolytic	6355-142	GE 76F02KD100
CR301	Diode, IN3067 Silicon	6357-74	Fairchild IN3067
CR302	Diode, IN3067 Silicon	6357-74	Fairchild IN3067
L301	Coil, 10 MH Choke	6394-63	Jeffers 1313-30J
L302	Coil, 33 MH Choke	6394-61	Nytronics 7405
Q301 thru Q304	Transistor 2N3859	K-172	GE 2N3859
Q305	Transistor 2N2270	K132	RCA 2N2270
Q306	Transistors 2N2339	K-146	RCA 2N2339

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
RESISTORS:	(Unless otherwise specified all components are fixed composition, ½ watt, 10% tolerance)		
R301	100K	1041-E	Allen Bradley EB-1041
R302	39K	3931-E	Allen Bradley EB 3931
R303 & R304	1K	1021-E	Allen Bradley EB 1021
R305 & R312	5K ½w pot, wire wound	9122-163	Beckman 89WR5K
R306	10K	1031-E	Allen Bradley EB 1031
R307	30K 5% tol	3035-E	Allen Bradley EB 3035
R308	82K	8231-E	Allen Bradley EB 8231
R309	3.9K	3921-E	Allen Bradley EB 3921
R310	220	2211-E	Allen Bradley EB 2211
R311 & R313	1.5K	1521-E	Allen Bradley EB 1521
R314	2.2K	2221-E	Allen Bradley EB 2221
R315	120K	1241-E	Allen Bradley EB 1241
R316	68K	6831-E	Allen Bradley EB 6831
R317	4.7K	4721-E	Allen Bradley EB 4721
R318	2K 5% tol	2025-E	Allen Bradley EB 2025
R319	68K	6831-E	Allen Bradley EB 6831
R320	20K 5% tol	2035-E	Allen Bradley EB 2035
R321	1.5K	1521-E	Allen Bradley EB 1521
R322	270	2711-E	Allen Bradley EB 2711
R323	4.7K	4721-E	Allen Bradley EB 4721
R324	1.2K	1221-E	Allen Bradley EB 1221
R325	39K	3931-E	Allen Bradley EB 3931
R326	12K	1231-E	Allen Bradley EB 1231
R327	2.7K	2721-E	Allen Bradley EB 2721
R328	27, 1 watt	2701-G	Allen Bradley GB 2701
R329	220	2211	Allen Bradley EB 2211

PARTS LIST, CARRIER OSCILLATOR AND MODULATOR, DWG. #B-7759-L

7759	PC Board #4 Assembly	7759-W	Kay Elemetrics Corp
CAPACITORS:			
C401	50µf, 25V, Electrolytic	6355-167	GE 76F02KF500
C402	35µf, 25V, Electrolytic	6355-150	GE 76F02KE350
*C403	.001µf, 500V, Ceramic Disc	6360-2	Sprague C023B501E102M
C404	35µf , 25V, Electrolytic	6355-150	GE 76F02KE350
C405 & C408 - C410	.05µf, 100V, Mylar Paper	6899-1	Elmenco 1DP-2-503
C406 & C407	.22µf, 50V, Mylar	6411-1	TRW 601PE
C411	.01µf, 500V, Ceramic Disc	6360-6	Sprague C023B501G103M
C412	1µf, 50V, Electrolytic	6355-107	GE 76F02LC1R0
C413	22µf, 15V, Electrolytic	6355-168	Kemet T110B226 K015A
C415	.02µf, 100V, Ceramic Disc	6360-58	Sprague Z5U
C416	IN953 Varactor	6357-97	Hughes IN953
C417	IN953 Varactor	6357-97	Hughes IN953
CR401	Diode IN3067	6357-74	Fairchild IN3067
CR402	Diode IN3067	6357-74	Fairchild IN3067
CR403	Diode IN3067	6357-74	Fairchild IN3067
CR404	Diode IN3067	6357-74	Fairchild IN3067
CR405	Not Used		
CR406	Not Used		
CR407	Diode IN4744	6357-109	Motorola IN4744
I401	Lamp 1835	249-1835	GE #1835
Q401	Transistor 2N3859	K-172	GE 2N3859
Q402	Transistor 2N2270	K-132	RCA 2N2270
Q403	Transistor 2N2270	K-132	RCA 2N2270
Q404	Transistor 2N3859	K-172	GE 2N3859
Q405	Transistor 2N3859	K-172	GE2N3859
RESISTORS:	(Unless otherwise specified, all components are fixed composition, ½ watt, 10% tolerance)		
R401	270	2711-E	Allen Bradley EB 2711
R402	100	1011-E	Allen Bradley EB 1011
R403 & R405	22K	2231-E	Allen Bradley EB 2231
R404	1.5K	1521-E	Allen Bradley EB 1521
R406	1K	1021-E	Allen Bradley EB 1021

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
R407	2K, ½ watt pot, variable	9122-165	Beckman "89WR2K
R408	1K	1021-E	Allen Bradley EB 1021
R409	1K	1021-E	Allen Bradley EB 1021
R410	390	3911-E	Allen Bradley EB 3911
R411	8.2K	8221-E	Allen Bradley EB 8221
R412	1.8K	1821-E	Allen Bradley EB 1821
R413	560	5615-E	Allen Bradley EB 5615
*R414	931, ¼ watt, 1% tol	6558-50	Mepco Type C10-931
R415	500, ½ watt pot, variable	4122-166	Beckman 89xR500
R416	3.9K	3921-E	Allen Bradley EB 3921
R417	2.2K	2221-E	Allen Bradley EB 2221
R418	82K	8231-E	Allen Bradley EB 8231
R419	33K	3331-E	Allen Bradley EB 3331
R420	464, ¼ watt	6558-344	Mepco C10-464
R421	3.9K	3921-E	Allen Bradley EB 3921
R422	27K	2731-E	Allen Bradley EB 2731
R423	100	1011-E	Allen Bradley EB 1011
R424	22K	2231-E	Allen Bradley EB 2231
R425	8.2K	8221-E	Allen Bradley EB 8221
R426	120K	1241-E	Allen Bradley EB 1241
R427	6.19K	6558-251	Mepco Type EP25 (RNGOD)
R428	33K	3331-E	Allen Bradley EB 3331
R429	6.19K	6558-251	Mepco Type EP25 (RNGOD)
R430	4.7K	4721-E	Allen Bradley EB 4721
R431	180	1811-E	Allen Bradley EB 1811
T401	Transformer, Special	8569A	Kay Elemetrics Corp
T402	Transformer, Special	8570D	Kay Elemetrics Corp
PARTS LIST, AGC AND IF AMPLIFIER, DWG. #B-7760-G			
7760	PC Board #5 Assembly	7760-W	Kay Elemetrics Corp
CAPACITORS:			
C501	.01μf, 400V, Mylar Paper	6899-8	Elmenco 4DP-1-103
C502	.01μf, 400V, Mylar Paper	6899-8	Elmenco 4DP-1-103
C503	470μμf, 500V, Mica	6359-79	Elmenco DM15-471
C504	2μf, 50V, Electrolytic	6355-164	GE 76F02LC2R0
C505	.01μf, 400V, Mylar Paper	6899-8	Elmenco 4DP-1-103
C506	.001μf, 600V, Mylar Paper	6899-10	Elmenco 6DP-1-102
C507	2μf, 50V, Electrolytic	6355-164	GE 76F02LC2R0
C508	.01μf, 400V, Mylar Paper	6899-8	Elmenco 4DP-1-103
C509	.01μf, 400V, Mylar Paper	6899-8	Elmenco 4DP-1-103
C510	2μf, 50V, Electrolytic	6355-164	GE 76F02LC2R0
C511	82μμf, 500V, Mica	6359-72	Elmenco DM15-820
C512	.01μf, 400V, Mylar Paper	6899-8	Elmenco 4DP-1-103
C513	.02μf, 100V, Mylar Paper	6899-13	Elmenco 1DP-1-203
C514	.02μf, 100V, Mylar Paper	6899-13	Elmenco 1DP-1-203
C515	390μμf, 500V, Mica	6359-65	Elmenco DM15-391
DIODES:			
CR501	1N100, Germanium	6357-76	Erie 1N100
CR502	1N100, Germanium	6357-76	Erie 1N100
CR503	1N100, Germanium	6357-76	Erie 1N100
TRANSISTORS:			
Q501	2N3859	K-172	GE 2N3859
Q502	2N3859	K-172	GE 2N3859
Q503	2N3568	K-187	Fairchild 2N3568
Q504	2N3859	K-172	GE 2N3859
Q505	2N3859	K-172	GE 2N3859
RESISTORS: (Unless otherwise specified, all components are fixed composition, ½ watt, 10% tolerance)			
R501	1.20K	1241-E	Allen Bradley EB 1241
R502	12K	1231-E	Allen Bradley EB 1231

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
R503	10K, ½ watt pot, variable	9122-85	Bourns 3067-1-103
R504	15K	1531-E	Allen Bradley EB 1531
R505	6.8K	6821-E	Allen Bradley EB 6821
R506	470	4711-E	Allen Bradley EB 4711
R507	8.2K	8221-E	Allen Bradley EB 8221
R508	270	2711-E	Allen Bradley EB 2711
R509	500, ½ watt pot, variable	9122-166	Beckman 89XR500
R510	120	1211-E	Allen Bradley EB 1211
R511	1.20K	1241-E	Allen Bradley EB 1241
R512	8.2K	8221-E	Allen Bradley EB 8221
R513	470	4711-E	Allen Bradley EB 4711
R514	8.2K	8221-E	Allen Bradley EB 8221
R515	470	4711-E	Allen Bradley EB 4711
R516	15K	1531-E	Allen Bradley EB1531
R517	3.3K	3321-E	Allen Bradley EB 3321
R518	180	1821-E	Allen Bradley EB 1821
R519	680	6811-E	Allen Bradley EB 6811
R520	120	1211-E	Allen Bradley EB 1211
R521	62K	6235-E	Allen Bradley EB 6235
R522	12K	1231-E	Allen Bradley EB 1231
R523	6.8K	8621-E	Allen Bradley EB 8621
R524	5K, ½ watt pot, variable	9122-167	Beckman 89XR5K
R525	2K	2025-E	Allen Bradley EB 2025
R526	1.2K	1221-E	Allen Bradley EB 1221
R527	3.9K	3921-E	Allen Bradley EB 3921
R528	270	2711-E	Allen Bradley EB 2711
R529	330	3311-E	Allen Bradley EB 3311
R530	100	1011-E	Allen Bradley EB 1011
R531	100	1011-E	Allen Bradley EB1011
R532	100	1011-E	Allen Bradley EB 1011
T501	Transformer, IF	8571	Kay Elemetrics Corp
T502	Transformer, IF	8571	Kay Elemetrics Corp

PARTS LIST, CALIBRATE BOARD, DWG. #C-8995-C

8995	PC Board #6 Assembly	8995-W	Kay Elemetrics Corp

CAPACITORS:

C601	.22μf, 50V, Mylar	6411-1	TRW 601PE
C602	.22μf, 50V, Mylar	6411-1	TRW 601PE
C603	.02μf, 100V, Mylar Paper	6899-13	Elmenco 1DP-1-203
C604	.22μf, 50V, Mylar	6411-1	TRW 601PE
C605	150μf, 25V, Electrolytic	6355-190	GE 76F92KM151
C606	.02μf, 100V, Mylar Paper	6899-13	Elmenco 1DP-1-203
C607	.02μf, 100v, Mylar Paper	6899-13	Elmenco 1DP-1-203
C608	750μμf, 500V, Mica	6359-67	Elmenco DM15-751
C609	500μμf, 300V, Mica	6359-66	Elmenco DM15-501
C610	Not Used		
C611	35μf, 25V, Electrolytic	6355-150	GE 76F02KE350
C612	300μμf, 500V, Mica	6359-64	Elmenco DM15-301
C613	300μμf, 500V, Mica	6359-64	Elmenco DM15-301
C614	.001μf, 600V, Mylar Paper	6899-10	Elmenco 6DP-1-102
C615	.015μf, 100V, Mylar Paper	6899-23	Elmenco 1DP-1-153
*C616	.03μf, 100V, Mylar Paper	6899-22	Elmenco 1DP-1-303
C617	680μμf, 500V, Mica	6359-80	Elmenco DM15-681
CR 601	Diode, 1N3067	6357-74	Fairchild 1N3067
CR 602	Diode, 1N3067	6357-74	Fairchild 1N3067

COILS:

L601	500MH, choke	6394-34	Caddell-Burns 1662-7
L602	.22MH, choke	6394-61	Nytronics
L603	Not Used		
L604	22 MH, choke	6394-61	Nytronics

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
L605	47MH, choke	6394-62	Nytronics
TRANSISTORS:			
Q601	2N2270	K-132	RCA 2N2270
Q602	2N2270	K-132	RCA 2N2270
Q603	2N4125	K-184	Motorola 2N4125
Q604	2N2270	K-132	RCA 2N2270
Q605	2N2270	K-132	RCA 2N2270
Q606	2N4125	K-184	Motorola 2N4125
Q607	2N2270	K-132	RCA 2N2270
Q608	2N2270	K-132	RCA 2N2270
Q609	2N4125	K-184	Motorola 2N4125
RESISTORS: (Unless otherwise specified, all components are fixed composition, ½ watt, 10% tolerance)			
R601	2.2K 5% tol	9292-34	Corning Glass C5-2200
R602	75K 5% tol	9292-30	Corning Glass C5-75K
R603	50K, ½ watt pot	9122-164	Beckman 89XR50K
R604	120K 5% tol	9292-31	Corning Glass C5-120K
R605	3K 5% tol	3025-E	Allen Bradley EB 3025
R606	2.2K 5% tol	9292-34	Corning Glass C5-2200
R607	2.2K 5% tol	9292-34	Corning Glass C5-2200
R608	22K	2231-E	Allen Bradley EB 2231
R609	470	4711-E	Allen Bradley EB 4711
R610	1.5K	1521-E	Allen Bradley EB 1521
R611	2.2K 5% tol	9292-34	Corning Glass C5-2200
R612	2.2K 5% tol	9292-34	Corning Glass C5-2200
R613	2.2K 5%tol	9292-34	Corning Glass C5-2200
R614	2.2K 5% tol	9292-34	Corning Glass C5-2200
R615	22K	2231-E	Allen Bradley EB 2231
R616	2K	2021-E	Allen Bradley EB2021
R617	43K 5% tol	9292-28	Corning Glass C5-43K
R618	50K, ½ watt pot	9122-164	Beckman 89XR50K
R619	62K 5% tol	9292-29	Corning Glass C5-62K
R620	2K 5% tol	2025-E	Allen Bradley EB 2025
R621	2.2K 5% tol	9292-34	Corning Glass C5-2200
R622	3.9K	3921-E	Allen Bradley EB 3921
R623	22K	2231-E	Allen Bradley EB 2231
R624	22K	2231-E	Allen Bradley EB 2231
R625	51K 5% tol	5135-E	Allen Bradley EB 5135
R626	62K 5% tol	9292-29	Corning Glass C5-62K
R627	2K 5% tol	2025-E	Allen Bradley EB 2025
R628	3K 5% tol	3025-E	Allen Bradley EB 3025
R629	51K 5% tol	5135-E	Allen Bradley EB 5135
R630	62K 5%tol	9292-29	Corning Glass C5-62K
R631	3K 5% tol	3025-E	Allen Bradley EB 3025
R632	22K	2231-E	Allen Bradley EB 2231
R633	470	4711-E	Allen Bradley EB 4711
R634	1.2K 5% tol	9292-27	Corning Glass C5-1.2K
R635	1.8K	1821-E	Allen Bradley EB 1821
PARTS LIST, MARK AMPLIFIER, DWG. #B-7762-K			
7762	Board #7 Assembly	7762-W	Kay Elemetrics Corp
CAPACITORS:			
C701	01μf, 100V, Ceramic Disc	6360-50	Erie 8121-100-657-1032
C702	10μf, 25V, Electrolytic	6355-142	GE 76F02KD100
C703	10μf, 25V, Electrolytic	6355-142	GE 76F02KD100
C704	2μf, 50V, Electrolytic	6355-164	GE 76F0LC2R0
C705	20μf, 50V, Electrolytic	6355-132	GE 76F01C330
C706	200μf, 500V, Mica	6359-63	Elmenco DM-15-201
J701	Not Used		
J702	Connector, 3 Contacts	217	Cinch Jones S-303AB
J701	Connector, 15 Contacts	6909-20	Amphenol 133-015-21

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURING & PART NO.
TRANSISTORS:			
Q701	2N3859	K-172	GE 2N3859
Q702	2N2270	K-132	RCA 2N2270
Q703	2N6247	K-227	RCA 2N6247
Q704	2N6247	K-227	RCA 2N6247
RESISTORS: (Unless otherwise specified, all components are fixed composition, $\frac{1}{2}$ watt, 10% tolerance)			
R701	5.6K 5% tol	5625-E	Allen Bradley EB 5625
R702	18K	1831-E	Allen Bradley EB 1831
R703	820	8211-E	Allen Bradley EB 8211
R704	220	2211-E	Allen Bradley EB 2211
R705	18	1801-E	Allen Bradley EB 1801
R706	56 5%	5605-E	Allen Bradley EB 5605
R707	56	5601-E	Allen Bradley EB 5601
R708	.82, 1 watt, wire wound	9292-17	IRC Type BWH
R709	.82, 1 watt, wire wound	9292-17	IRC Type BWH
R710	1.5K, 1 watt	1521-G	Allen Bradley GB 1521
R711	2.2K	2221-E	Allen Bradley EB 2221
R712	1.5K, 1 watt	1521-G	Allen Bradley GB 1521
T701	Transformer, special	8573B	Kay Elemetrics Corp
NOTE: * P702 not on Board, on cable from Mechanical Unit.			
PARTS LIST, SECTIONER, DWG. #B-7763-H			
7763	PC Board #8 Assembly	7763-W	Kay Elemetrics Corp
CAPACITORS:			
C801	.01μf, 400V, Mylar Paper	6899-11	Elmenco 4DP-3-104
C802	.01μf, 400V, Mylar Paper	6899-8	Elmenco 4DP-3-104
C803	.1μf, 100V, Mylar Paper	6899-11	Elmenco 1DP-2-104
C804	.001μf, 600V, Mylar Paper	6899-10	Elmenco 6DP-1-102
C805	.22μf, 50V, Mylar	6411-1	TRW 601PE
C806	10μf, 25V, Electrolytic	6355-190	GE 76F02KD100
C807	.22μf, 50V, Mylar	6411-1	TRW 601PE
C808	150μf, 25V, Electrolytic	6355-190	GE 76F92KM151
C809	470μμf, 500V, Mica	6359-79	Elmenco DM15-471
C810	470μμf, 500V, Mica	6359-79	Elmenco DM15-471
C811	2μf, 50V, Electrolytic	6355-164	GE 76F02LC2R0
DIODES:			
CR 801	1N100, Germanium	6357-76	Raytheon 1N100
CR 802	1N100, Germanium	6357-76	Raytheon 1N100
CR 803	1N4446	6357-125	Fairchild 1N4446
CR 804	1N4446	6357-125	Fairchild 1N4446
CR 805	1N4446	6357-125	Fairchild 1N4446
TRANSISTORS:			
Q801	2N3859	K-172	GE 2N3859
Q802	2N3859	K-172	GE 2N3859
Q803	2N2270	K-132	RCA 2N2270
Q804	2N3569	K-179	Fairchild 2N3569
Q805	2N3569	K-179	Fairchild 2N3569
Q806	2N3563	K-188	Fairchild 2N3563
Q807	2N3563	K-188	Fairchild 2N3563
RESISTORS: (Unless otherwise specified, all components are fixed composition, $\frac{1}{2}$ watt, 10% tolerance)			
R801	8.2K	8221-E	Allen Bradley EB 8221
R802	33K	3331-E	Allen Bradley EB 3331
R803	4.7K	4721-E	Allen Bradley EB 4721
R804	470	4711-E	Allen Bradley EB 4711
R805	1K	1021-E	Allen Bradley EB 1021

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
R806	680	6811-E	Allen Bradley EB 6811
R807	470	4711-E	Allen Bradley EB 4711
R808	2.2K	2221-E	Allen Bradley EB 2221
R809	51 5% tol	5105-E	Allen Bradley EB 5105
R810	7.5K 5% tol	7525-E	Allen Bradley EB 7525
R811	22	2201-E	Allen Bradley EB 2201
R812	10K, ½ watt pot, wire wound	9122-120	Beckman 77PR 10K
R813	12K	1231-E	Allen Bradley EB 1231
R814	18	1801-E	Allen Bradley EB 1801
R815	100K	1041-E	Allen Bradley EB 1041
R816	7.5K 5% tol	7525-E	Allen Bradley EB 7525
R817	1K	1021-E	Allen Bradley EB 1021
R818	510 5% tol	5115-E	Allen Bradley EB 5115
R819	7.5K 5% tol	7525-E	Allen Bradley EB 7525
R820	1K	1021-E	Allen Bradley EB 1021
R821	100	1011-E	Allen Bradley EB 1011
R822	430 5% tol	4311-E	Allen Bradley EB 4311
R823	100	1011-E	Allen Bradley EB 1011
R824	500, ½ watt pot, wire wound	9122-84	Bourne 3067P-1-501
K801	Relay, Mercury	9171	Adams & Westlake Co. MWSA 16121

PARTS LIST, POWER SUPPLY, DWG. #10238-K

8120	PC Board #9 Assembly	8120W	Kay Elemetrics Corp

CAPACITORS:

C901	Not Used		
C902	50µf, 50V, Electrolytic	6355-114	Cornell Dubilier N LW
C903	Not Used		
C904	Not Used		
C905	50µf, 50V, Electrolytic	6355-114	Cornell Dubilier NLW
C906	50µf, 50V, Electrolytic	6355-114	Cornell Dubilier NLW
C907	.001µf, 600V, Mylar Paper	6899-10	Elmenco 6DP-1-102

DIODES:

*CR901 thru CR904	Bridge (4 Drode Bridge)	6357-102	Motorola MDA 952-1
CR 905	F6, Silicon	6357-3	Sarkes Tarzian F6
CR906	F6, Silicon	6357-3	Sarkes Tarzian F6
CR907	F6, Silicon	6357-3	Sarkes Tarzian F6
CR908	F6, Silicon	6357-3	Sarkes Tarzian F6
CR909	1N4736 Zener	6357-98	Motorola 1N4736
CR910	1N4736 Zener	6357-98	Motorola 1N4736
CR911	1N4750 Zener	6357-101	Motorola 1N4750

TRANSISTORS:

Q901	2N2270	K-132	RCA - 2N2270
Q902	2N3859	K-172	GE 2N3859
Q903	2N1701	K-140	RCA 2N1701

RESISTORS: (Unless otherwise specified, all components are fixed composition, ½ watt, 10% tolerance)

R901	2.2K	2221-E	Allen Bradley EB 2221
R902	10K	1031-E	Allen Bradley EB 1031
R903	8.2K	8221-E	Allen Bradley EB 8221
R904	1K	1021-E	Allen Bradley EB 1021
R905	1K, 1 watt pot	9122-130	Beckman 72PMR1K
R906	1K, 1% tol	9292-233	Mepro type RN65D
R907	549, 1% tol	6558-282	Mepro type RN60D
R908	1.5K, 1 watt	1521-G	Allen Bradley GB1521

NOTE: * (Diode Bridge mounted on chassis)

PARTS LIST, PLUG-IN FILTER, DWG. #B-8617-G

8617	Plug-In Filter (complete)	8617W	Kay Elemetrics Corp.

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
CAPACITORS:			
C1001	.02μf, 100V, Mylar Paper	6899-13	Elmenco DP-1-203
C1002	2μf, 50V, Electrolytic	6355-164	GE 76F02LC2R0
C1003	.02μf, 100V, Ceramic Disc	6360-58	Sprague Z5U
C1004	.02μf, 100V, Ceramic Disc	6360-58	Sprague Z5U
C1005	.05μf, 100V, Ceramic Disc	6360-59	Sprague Z5U
C1006	.1μf, 100V, Ceramic Disc	6360-52	Electro Materials 5030FS100RD104M
C1007	.2μf, 100V, Ceramic Disc	6360-54	Erie 8131-100-651-204Z
C1008	2μf, 50V, Electrolytic	6355-164	GE 76F02LC2R0
FL1001	Filter, Wide	8360-2	Kay Elemetrics Corp
FL1002	Filter, Narrow	8360-1	Kay Elemetrics Corp
P9	Connector, 8 contacts	6909-15	Amphenol 26-182
TRANSISTORS:			
Q1001	2N3859	K-172	GE 2N3859
Q1002	2N3859	K-172	GE 2N3959
Q1003	2N3859	K-172	GE 2N3859
RESISTORS: (Unless otherwise specified, all components are fixed composition, ¼ watt, 10% tolerance)			
R1001	6.2K 5% tol.	6225-C	Allen Bradley CB 6225
R1002	39K	3935-C	Allen Bradley CB 3935
R1003	5.6K	5621-C	Allen Bradley CB 5621
R1004	1K	1021-C	Allen Bradley CB 1021
*R1005	Factory Selected		
R1006	7.5K 5% tol	7525-C	Allen Bradley CB 7525
R1007	33K	3331-C	Allen Bradley CB 3331
*R1008	220	2211-C	Allen Bradley CB 2211
*R1009	180	1811-C	Allen Bradley CB 1811
R1010	1.2K	1221-C	Allen Bradley CB 1221
R1011	220	2211-C	Allen Bradley CB 2211
R1012	270	2711-C	Allen Bradley CB 2711
R1013	2.2K	2221-C	Allen Bradley CB 2221
S1001	Switch, Rotary 2 pos, 1 wafer	6393-3	Oak Mfg. 399235
* factory select			
PARTS LIST, VU METER, DWG. #D-10238-K			
8607	PC Board Assembly	8607-W	Kay Elemetrics Corp
CR1201	F6, Silicon	6357-3	Sarkes Tarzian F6
CR1202	F6, Silicon	6357-3	Sarkes Tarzian F6
CR1203	F6, Silicon	6357-3	Sarkes Tarzian F6
CR1204	F6, Silicon	6357-3	Sarkes Tarzian F6
CR1205	F6, Silicon	6357-3	Sarkes Tarzian F6
CR1206	F6, Silicon	6357-3	Sarkes Tarzian F6
R1201	8.2K, ½ watt	8221-E	Allen Bradley EB 8221
PARTS LIST, LOW PASS FILTER BOX ASSEMBLY, DWG. #D-10238-K			
8618	Filter Box Assembly (wired)	8618-W	Kay Elemetrics Corp
CAPACITORS:			
C1301	500μμf, 500V, Mica	6359-66	Elmenco DM15-501
C1302	.002μf, 600V, Mylar Paper	6899-4	Elmenco 6DP-1-202
C1303	.002μf, 600V, Mylar Paper	6899-4	Elmenco 6DP-1-202
C1304	.22μf, 50V, Mylar	6411-1	TRW 601PE
C1305	390μμf, 500V, Mica	6359-65	Elmenco DM15-391
*C1306	300μμf, 500V, Mica	6359-64	Elmenco DM15-301
C1307	300μμf, 500V, Mica	6359-64	Elmenco DM15-301
C1308	300μμf, 500V, Mica	6359-64	Elmenco DM15-301

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
L1301	1.5 MH Choke	6394-26	Miller 4664
L1302	2.4 MH Choke	6394-27	Miller 4666
L1303	1.5 MH Choke	6394-26	Miller 4664
R1301	1.3K 5% tol	1325-E	Allen Bradley EB 1325

PARTS LIST, RECORD PRE-AMPLIFIER, DWG. #D-10238-K

	Input selector Assembly	10030	Kay Elemetrics Corp
CAPACITORS:			
C1401	10μf, 25V, Electrolytic	6355-142	GE 76F02KD100
C1402	2μf, 50V, Electrolytic	6355-128	GE 76F02LC2R0
C1403	35μf, 25V, Electrolytic	6355-150	GE 76Fo2KE350
C1404	10μf, 25V, Electrolytic	6355-142	GE 76F02KD100
J1401	Connector, INPUT	6909-102	Cannon XLR-3-31
J1402	UG 625/U	6909-81	Specialty 28JR121-2
*J1403	UG 625/U (optional)	6909-81	Specialty 28JR121-2
Q1401	2N3859	K-172	GE 2N3859
Q1402	2N3859	K-172	GE 2N3859

RESISTORS: (Unless otherwise specified, all components are fixed composition, ½ watt, 10% tolerance)

R1401	120K	1241-E	Allen Bradley EB 1241
R1402	33K	3331-E	Allen Bradley EB 3331
R1403	12K	1231-E	Allen Bradley EB 1231
R1404	750 5% tol	7515-E	Allen Bradley EB 7515
R1405	30K 5% tol	3050-E	Allen Bradley EB 3050
R1406	5.6K	5621-E	Allen Bradley EB 5621
R1407	2.7K	2721-E	Allen Bradley EB 2721
R1408	4.7K	4721-E	Allen Bradley EB 4721
T1401	Matching Transformer	8582	UTC O-2

PARTS LIST, LOG-LIN FREQUENCY RANGE CIRCUIT, DWG. #10238-K

	Log-Lin Frequency Range Assembly 1041l		
I1701	Lamp, 6 watt, 120V	1850	GE 656
Q1701	2N3859	K-172	GE 2N3859

RESISTORS: (Unless otherwise specified, all components are fixed composition, ½ watt, 10% tolerance)

R1701	173, ¼ watt, 1% tol	6558-345	United Mineral Corp LCA-0309
R1702	500, ½ watt pot, wire wound	9122-124	Beckman 78PR500
R1703	443, ¼ watt, 1% tol	6558-346	United Mineral Corp LCA-0309
R1704	500, ½ watt pot, wire wound	9122-124	Beckman 78PR500
R1705	443, ¼ watt, 1% tol	6558-346	United Mineral Corp LCA-0309
R1706	790, ¼ watt, 1% tol	6558-347	United Mineral Corp LCA-0309
R1707	500, ½ watt pot, wire wound	9122-124	Beckman 78PR500
R1708	500, ½ watt pot, wire wound	9122-124	Beckman 78PR500
*R1709	Factory Selected		
R1710	12.1K, ¼ watt, 1% tol	6558-348	Mepco C10-12.1K (RN60D)
R1711	2.443K, ¼ watt, 1% tol	6558-75	Mepco C10-2.443K (RN60D)
*R1712	Factory Selected		

SECTION 6B

MECHANICAL

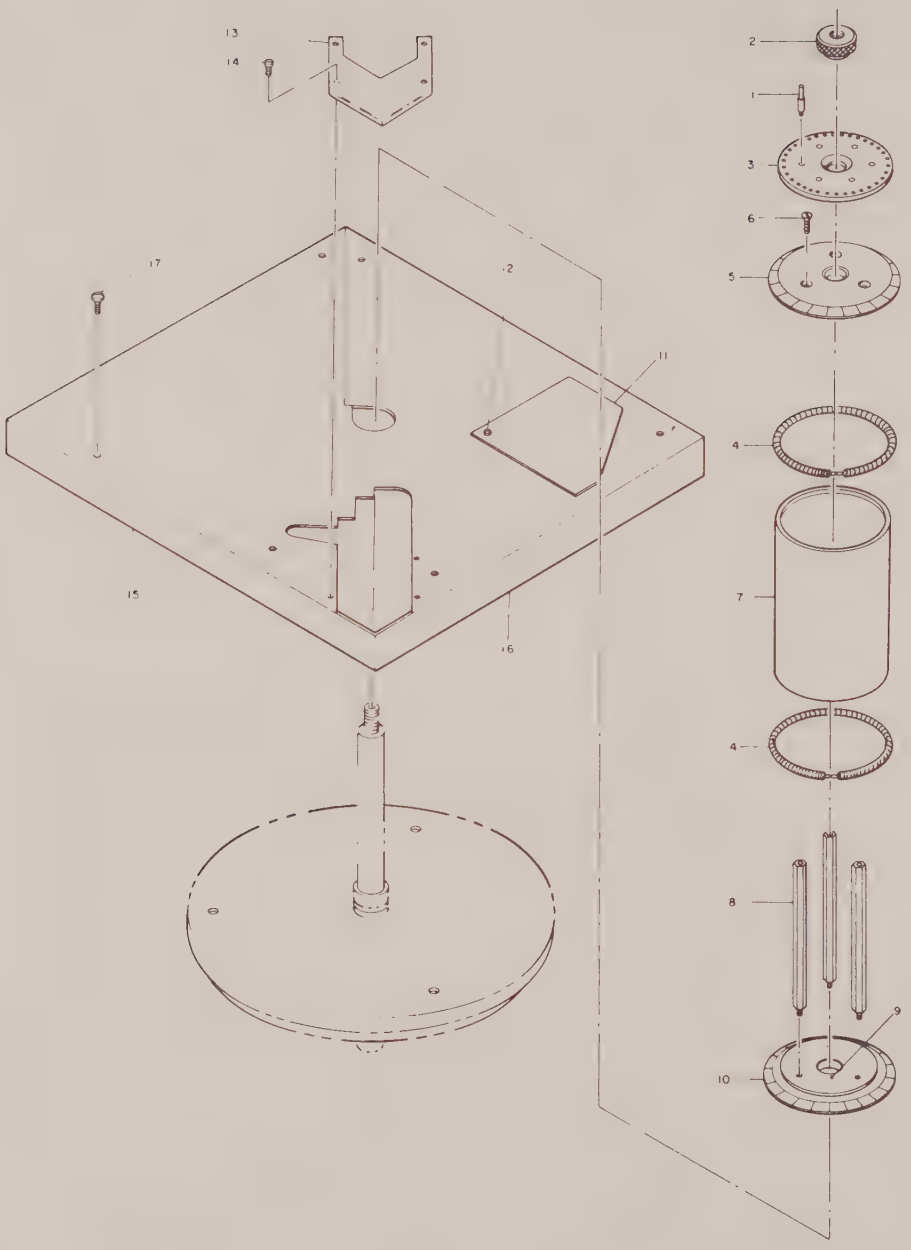


Figure 1. Spectrum Analyzer Mechanical Assembly (Sheet 1 of 3)

Fig. & Index No.	Description	Part No.	Quantity
1-	SPECTRUM ANALYZER ..... (Mechanical Assy.)	9977	1
-1	. PIN, Tripping	9007	6
-2	. NUT, Plain, Knurled	939	1
-3	. PLATE, Micrometer	9371	1
	* DRUM ASSEMBLY, 60 cps	7990-60	1
-4	. SPRING, Garter, Extension	533	2
-5	. PLATE, Top	622	1
-6	. SCREW, Machine ..... (10-32 X 1/2" FILHBRSNP)	COML.	3
-7	. DRUM	609	1
-8	. POST, Electrical- Mech	551	3
-9	. PIN, Straight headless	672	1
-10	. PLATE, Bottom	623	1
	----*----		
-11	. COVER, Inspection	7404	1
-12	. SCREW, Machine ..... (6-32 X 1/4" BDGHBRSNP)	COML.	1
-13	. COVER, Corner	7692	1
-14	. SCREW, Machine ..... (4-40 X 1/4" BD GHBRSNP)	COML.	4
-15	. COVER, Left	10036-2	1
-16	. COVER, Right	10035-3	1
-17	. SCREW, Machine ..... (6-32 X 1/4 BDGHBRSNP)	COML.	6
	----*----		
-18	. BELT, Drive	627	1

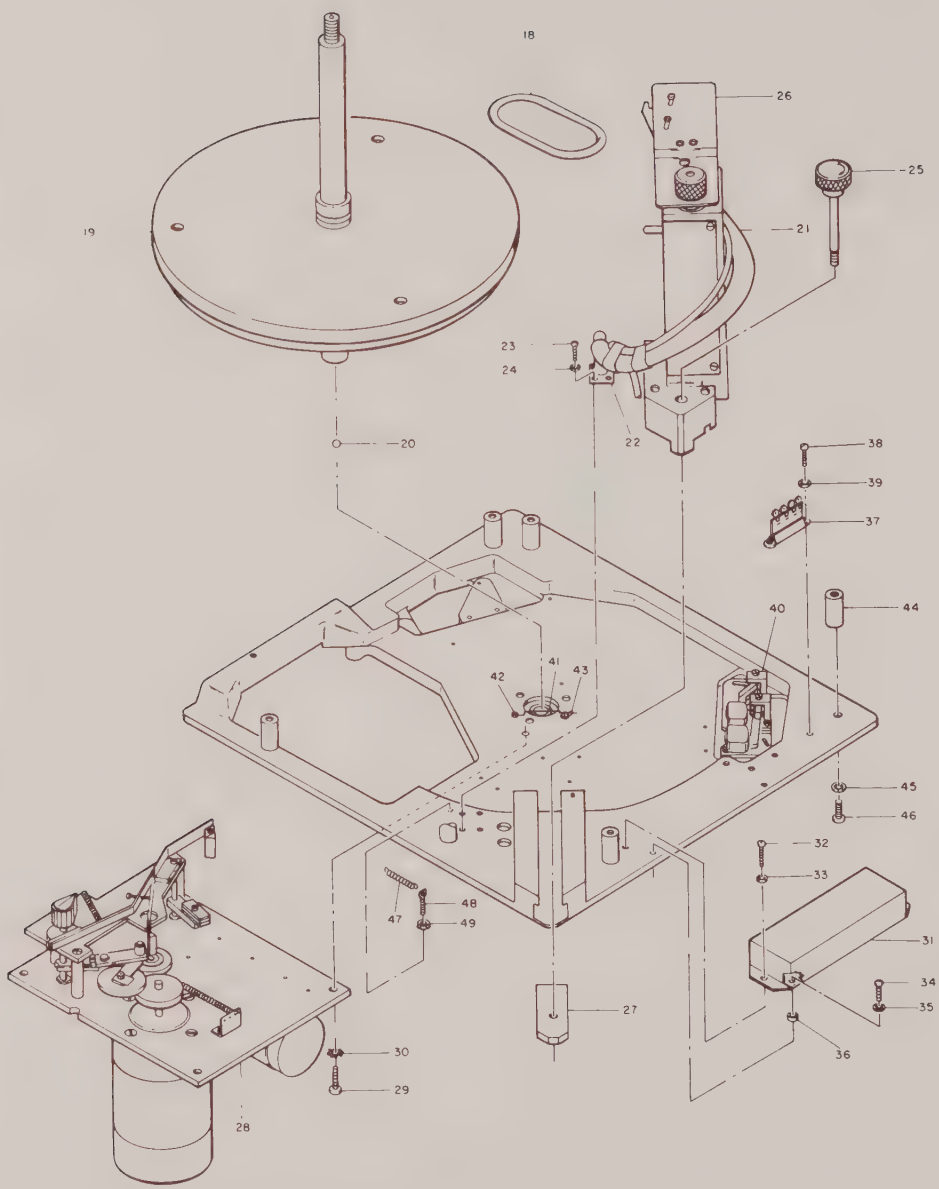


Figure 1. Spectrum Analyzer Mechanical Assembly (Sheet 2 of 3)

Fig. & Index No.	Description	Part No.	Quantity
-18	. BELT, Drive	627	1
-19	. TURNTABLE ASSEMBLY	9357	1
-20	. BALL, Bearing 9/32 S/S	7537-4	1
-21	. TUBE, Rubber, Top	7436-3	1
-22	. CONNECTOR, Right Angle	7408	1
-23	. SCREW, Machine ..... (4-40 X 1/4" BDGHBRSNP)	COML.	4
-24	. WASHER, Lock, No. 4 INT.....	COML.	4
	----*----		
-25	. KNOB, Stylus-Resistor ..... Assy.	7754	1
-26	* STYLUS-RESISTOR ASSY ..... (See Fig. 2 For Breakdown)	8651	1
-27	. PLATE, Clamp	7689	1
-28	* DRIVE ASSEMBLY ..... (See Fig. 3 For Breakdown)	10173	1
1-29	. SCREW, Machine	COML.	4
-30	. WASHER, Lock, No. 10, Ext.	COML.	4
-31	. COVER, P C Board	9354	1
-32	. SCREW, Machine ..... (4-40 X 1/4" BDGHBRSNP)	COML.	2
-33	. WASHER, Lock, No. 4 EXT.	COML.	2
-34	. SCREW, Machine ..... (4-40 X 1/4" BDGHBRSNP)	COML.	4
-35	. WASHER, Lock, No. 4 INT	COML.	4
-36	. SPACER, P C BD mounting	10224	4
-37	. TERMINAL STRIP	365	1
-38	. SCREW, Machine ..... (6-32 X1/4" BDGHBRSNP)	COML.	2
-39	. WASHER, Lock, No. 6 INT	COML.	2
-40	* RECORD-REPRODUCE HEAD ... ASSY. (Fig. 4 for Breakdown)	9979	1
-41	. SPRING, Contact	10348	1
-42	. SCREW, Machine ..... (4-40 X 1/4" BDGHBRSNP)	COML.	2
-43	. TERMINAL, Lug, No. 2	COML.	1
-44	. POST, Electrical-Mech	610	6
-45	. SCREW, Machine ..... (6-32 X 3/4" BDGHBRSNP)	COML.	6
-46	. WASHER, Lock, No. 6 INT.	COML.	6
-47	. SPRING, Helical extension	9743	1
-48	. HOLDER, Spring	9745	1
-49	. NUT, Assembled Washer ..... (6-32 SCDP)	COML.	1

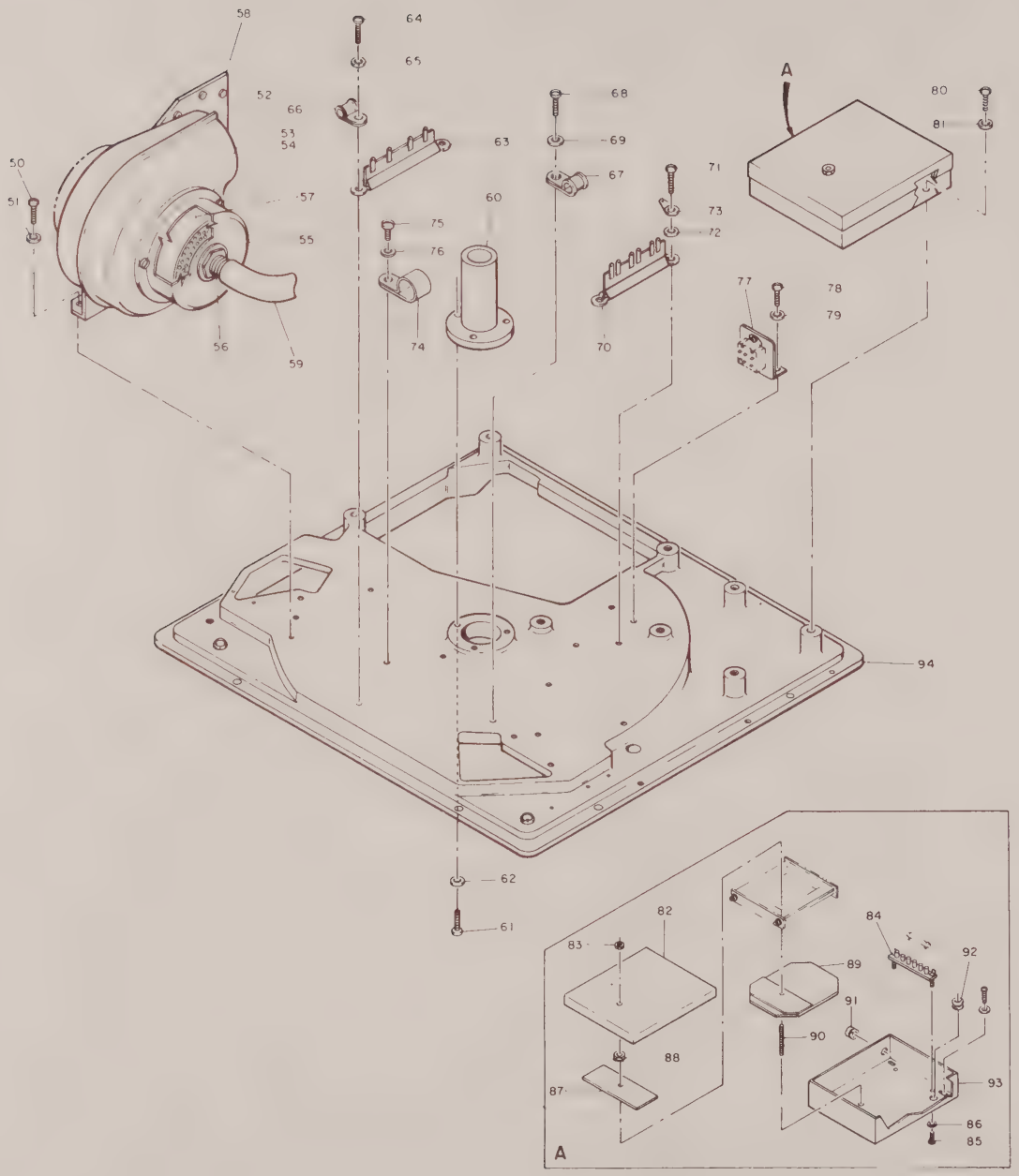


Figure 1. Spectrum Analyzer Mechanical Assembly (Sheet 3 of 3)

Fig. & Index No.	Description	Part No.	Quantity
	*MOTOR ASSEMBLY, Blower	7986	1
-50	. SCREW, Machine ..... (10-32 X 1/2" BDGHBRSNP)	COML.	2
-51	. WASHER, Lock, No. 10 INT.....	COML.	2
-52	.RING, Retaining	7021-3	1
-53	.SCREW, Machine ..... (6-32 X 1/2" BDGHBRSNP)	COML.	3
-54	. WASHER, Lock, No. 6 INT.	COML.	3
	* FILTER ASSEMBLY	7021-5	1
-55	.BOOT, Rubber	7021-8	1
-56	. TUBE, BRASS	7021-4	1
-57	. FILTER, Cartridge	7021-7	1
1-58	. BRACKET, Motor Mounting	10331	1
-59	.TUBE, Rubber, Bottom	7436-2	1
	----*----		
-60	* BEARING & HOUSING ASSY	633	1
-61	. SCREW, Machine ..... (10-32 X 5/8" FILHBRSNP)	COML.	3
-62	. WASHER, Lock, No. 10 INT.	COML.	3
	----*----		
-63	. TERMINAL STRIP	8666-1	1
-64	. SCREW, Machine ..... (6-32 X 1/4" BDGHBRSNP)	COML.	2
-65	. WASHER, Lock, No. 6 INT.	COML.	2
-66	. CLAMP, Loop	329-2	1
-67	. CLAMP, Loop	329-4	1
-68	. SCREW, Machine ..... (10-32 X 3/8" BDGHBRSNP)	COML.	1
-69	. WASHER, Lock, No. 10 INT.	COML.	1
-70	. TERMINAL, STRIP	8666-2	1
-71	. SCREW, Machine ..... (6-32 X 1/4" BDGHBRSNP)	COML.	2
-72	. WASHER, Lock, No. 6 INT..	COML.	2
-73	. TERMINAL, LUG	7180	1
-74	. CLAMP, Loop	10386	1
-75	. SCREW, Machine ..... (6-32 X 3/8" BDGHBRSNP)	COML.	1
-76	. WASHER, Lock, No. 6 INT	COML.	1
-77	. BRACKET, Connector	9963	1
-78	. SCREW, Machine	COML.	2
-79	. WASHER, Lock, No. 6 INT	COML.	2
	* BOX ASSEMBLY, Transformer	8655	1
-80	. SCREW, Machin ..... (6 - 32 X 1/4" BDGHBRSNP)	COML.	4
-81	. WASHER, Lock, No. 6 INT .	COML.	4
-82	. COVER, Transformer box	8363-2	1
-83	. NUT, Assembled Washer ..... (6-32 SCDP)	COML.	1
-84	. TERMINAL BOARD	5515	1
-85	. SCREW, Machine ..... (3-48 X 1/4" BDGHBRSNP)	COML.	2
-86	. WASHER, Lock, No. 3 INT	COML.	2
1-87	. PLATE, Clamp	8600	1
-88	. NUT, Assembled Washer	COML.	1
-89	. PLATE, Insulator	8599	1
-90	. ROD, Threaded, Nylon	8791	1
-91	. GROMMET, Rubber	7121	1
-92	. GROMMET, Rubber	7171	1
-93	Box Transformer	8363-1	1
-94	. CASTING, Painted	9353	1

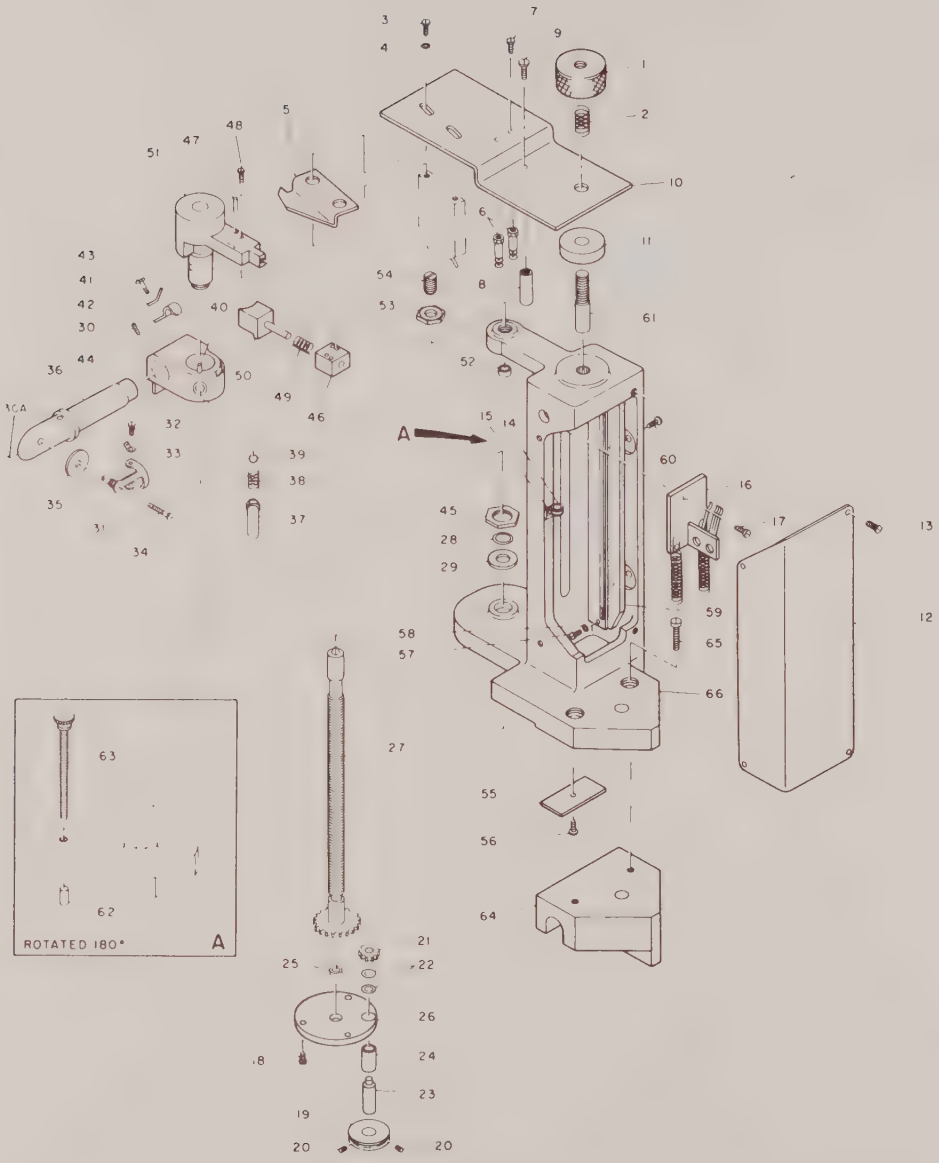


Figure 2. Stylus - Resistor Assembly

Fig. & Index No.	Description	Part No.	Quantity
2-	* STYLUS-RESISTOR ASSY	8651	1
	* PLATE, ASSY. (Sectioner)	8684	1
-1	. NUT, Plain, Knurled	936	1
-2	. SPRING, Helical, (comp.)	535	1
-3	. SCREW, Machine, ... (4 - 40 X 5/16'' BDGHBRSNP)	COML.	2
-4	. WASHER, Flat, No. 4 SCDP	COML.	2
-5	. INDEX ARM	8601	1
-6	. TERMINAL, Stud	10385	2
-7	. SCREW, Machine ..... (4 - 40 X 3/16'' BDGHBRSNP)	COML.	2
-8	.POST, Stop	8038	1
-9	. SCREW, Machine ..... (8 -32 X 5/16'' BDGHBRSNP)	COML.	1
-10	.PLATE, Sectioner	8037	1
	----*----		
-11	. SPACER, Sleeve	940	1
-12	.COVER, Access	8966	1
-13	. SCREW, Machine ..... (4 - 40 X 1/4'' BDGHBRSNP)	COML.	4
-14	.CLAMP, Loop	329-3	1
-15	. SCREW, Machine ..... (4 - 40 X 5/16'' BDGHBRSNP)	COML.	1
-16	* CONTACT ASSY', Slider	8681	1
-17	. SCREW, Machine	COML.	1
	----*----		
	* PLATE ASSY, Bearing	8679	1
-18	. SCREW, Machine	COML.	3
-19	. PULLEY, Groove	9376	1
-20	. SETSCREW, 4-40 X 1/8	COML.	2
-21	. GEAR, Spur, 12 teeth	522	1
-22	. WASHER, Flat 3/16'' ID ..... (5.16'' OD,.010'' THK)	9562	2
-23	. SHAFT	524	1
-24	. BEARING, Sleeve	10679	1
-25	. BEARING, Ball	593	1
-26	. PLATE, Bearing	526	1
2-27	* LEADSCREW & GEAR ASSY	8682	1
-28	. WASHER, Flat 3/8'' ID..... (1/2'' OD, .010'' THK)	576	1
-29	. WASHER, Nonmetallic 3/8 ID (5/8'' OD, 3/32'' THK)	554	1
	----*----		
	* STYLUS ASSEMBLY	8677	1
	* STYLUS WIRE ASSY	8675	1
-30	. SETSCREW, 6 - 32 X 1/8''	COML.	1
-31	* SPRING & STUD ASSY	8676	1
-32	. SCREW, Machine ..... (2 - 56 X 1/8'' RHBRSNP)	COML.	2
-33	. TERMINAL, Lug, No. 2	5165	1
-34	. SCREW, Adjustment ..... (2-56 X 5/8'' lg)	573	1
-35	. NUT, ADJ., Nonmetallic	568	1

Fig. & Index No.	Description	Part No.	Quantity
-36	. TUBE, Nonmetallic	579	1
-37	. KNOB, Cam	571	1
-38	. SPRING, Helical, (comp.).....	525	1
-39	. BALL, Bearing 3/16" dia.	571A	1
-40	. PIN, Straight, headless ..... (1/16" dia. , 1/4 " lg.)	619	1
-41	. TERMINAL, Lug	7108	1
-42	. STRAP, Retaining	501	1
-43	. SCREW, Machine ..... (6-32 X 1/8 " BDGHBRSNP)	COML.	1
-44	. CAM & LOCKPLATE ASSY	7440	1
-45	. NUT, Plain, Hexagon	553	1
-46	. GUIDE BLOCK	519	1
-47	. PIN, Grooved, headless ..... (1/16 " dia. 7/16 " lg.)	643	1
-48	. SCREW, Machine ..... (3/48 X 7/16 " lg.)	COML.	2
-49	. SPRING, Helical, (comp.)	523	1
-50	. HALFNUT & SHAFT	491	1
-51	. FOLLOWER	500	1
	----*----		
-53	. NUT, Plain, hexagon, ... (5/16-32 x 3/32 " THK.)	527	1
-54	. STUD, Threaded	495	1
-55	. PLATE ASSY. Insulator	8680	1
2-56	. SCREW, Machine ..... (6-32 x 1/4 " BDGHBRSNP)	COML.	1
-57	. SCREW, Machine ..... (4-40 x 5/16 " BDGHBRSNP)	COML.	2
-58	. WASHER, Lock, No. 4 SCDP	COML.	2
-59	. BAR, Resistor Mounting	9524	1
-60	. SCREW, Machine ..... (6-32 x 3/8 " BDGHBRSNP)	COML.	2
-61	. STUD, Threaded ..... (1/4 - 20 x 1 -3/8 ")	629	1
-62	. SLEEVE, Rubber	583	1
-63	. THUMBSCREW	680	1
-64	. SPACER BLOCK, Stylus	7688	1
-65	. SCREW, Machine ..... (10 - 32 x 5/8 " FILHBRSNP)	COML.	2
-66	. HOUSING, Stylus	7685	1

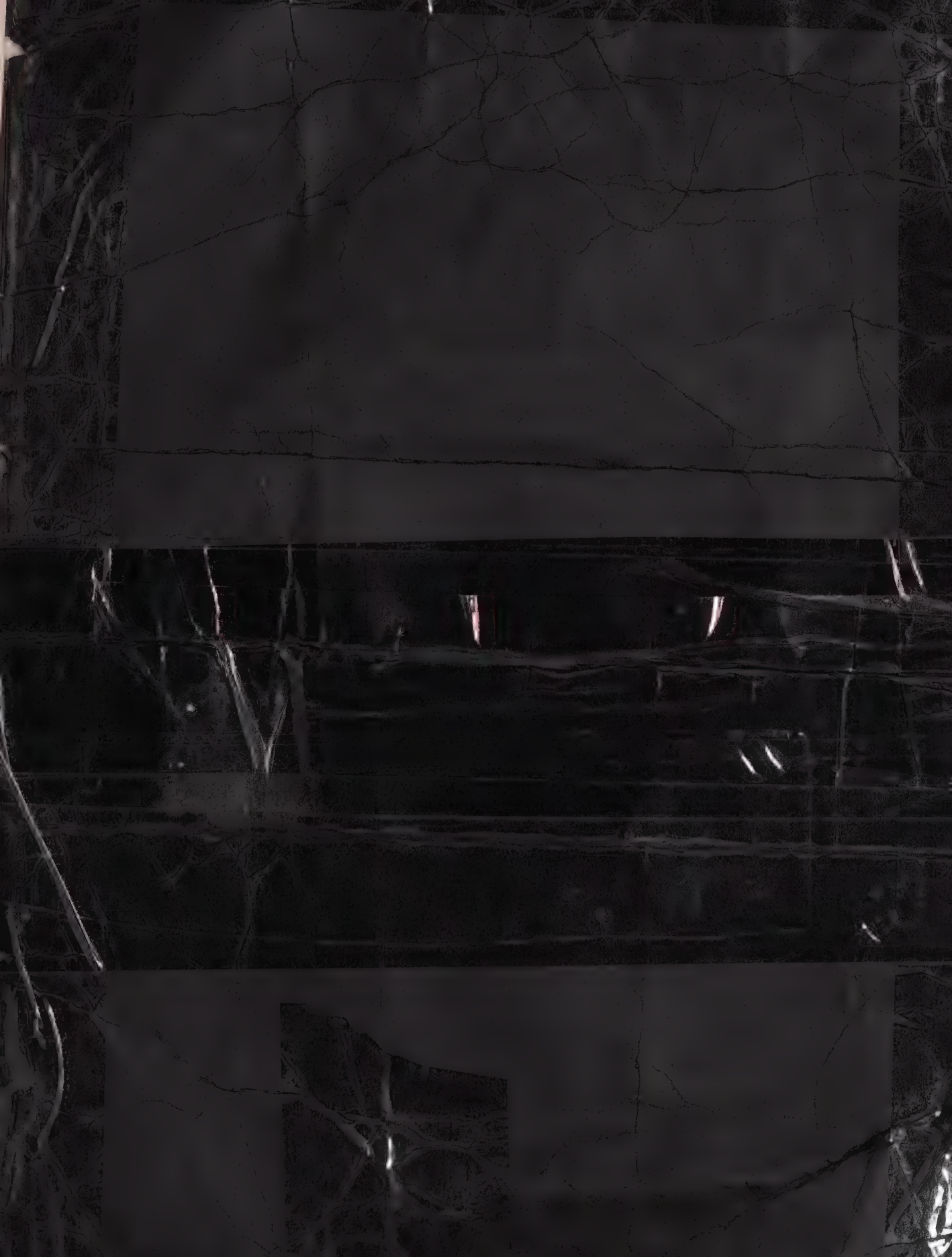


Fig. & Index No.	Description	Part No.	Quantity
3-	* DRIVE ASSEMBLY, 60 CPS	10173-6	1
	50 CPS	10173-5	1
-1	. KNOB, Pointer	4927	1
-2	. CAM, No. 7	11141	1
-3	. SETSCREW, 6-32 x 3/16	COML.	2
-4	. SPRING, Helical, Ext.	9744	1
	----*-----		
	* BRAKE ARM & WIPER ASSY	11091	1
-5	. SETSCREW 6-32 x 1/8	COML.	2
-6	. SCREW, Adjusting ..... (4-40 x 7/8 " RHGRSNP)	COML.	2
-7	. NUT, Plain, Hexagon ..... (4-40 SCDP)	COML.	1
-8	. ARM, Control Brake	11136.	1
-9	. SCREW, Machine ..... (4-40 x 3/8 " BDGHBRSNP)	COML.	2
-10	. WASHER, Lock No. 4 INT.....	COML.	2
-11	. WIPER, Brake Arm	11090-3	2
-12	. SCREW, Machine	COML.	1
-13	. WASHER, Lock, No 4 INT.	COML.	1
-14	. SPRING ARM, Wiper	11089	1
-15	. BRACKET, Brake	10147	1
-16	. HOLDER, Spring	9745	1
-17	. NUT, Assembled Washer ..... (6-32 SCDP)	COML.	1
-18	. BEARING, Flange	10676	2
-19	. PLATE, TOP	10032	1
-20	. SCREW, Machine ..... (10-32 x 3/8 " BDGHSST)	COML.	3
-21	. SPACER, Sleeve	9985	3
-22	. SCREW, Machine	COML.	3
-23	. WASHER, Lock, No. 10 Ext.	COML.	3
-24	. SHOE, Brake, Leather	10149	3
-25	. SCREW, Machine ..... (10-32 x 5/8 " FILHSST)	COML.	1
-26	. RING, Retaining	10675	1
-27	* SHAFT ASSY., Brake	10146	1
-28	. SPRING, Anti-chatter	9991	1
3-29	. SCREW, Machine, ...	COML.	1
-30	. ARM # 6, Control	10383	1
-31	. SCREW, Machine ..... (4-40 x 1/4 " BDGHBRSNP)	COML.	2
-32	. WASHER, Lock, No. 4 INT	COML.	2
-33	. RING, Retaining	10675	2
-34	. SCREW, Cap, socket head ..... (8 - 32 x 1/4 SCHSTL)	COML.	2
-35	. ARM # 1	10018	1
-36	. SHAFT, No. 2	10000	1
-37	. HOLDER, SPRING No. 1	10027	1
-38	. ARM, No. 5 recording	9997	1
-39A	. SHAFT, No. 1	9999	1
-39	. WHEEL, Recording	9996	1
-40	. ARM, No. 7	10453	1
-41	. SCREW, machine ..... (4 - 40 x 1/4 " BDGHBRSNP)	COML.	2
-42	. WASHER, Lock, No. 4 INT.	COML.	2

Fig. & Index No.	Description	Part No.	Quantity
-43	. SPRING, Helical, Ext	9743	1
-44	. HOLDER, Spring, No. 3	10029	1
-45	. SCREW, Machine ..... (10 - 32 x 3/8 '' BDGHBRSNP)	COML.	1
-46	. WASHER, Lock, NO' 10 INT.	COML.	1
-47	. SCREW, Cap, socket head	COML.	2
-48	. RING, RETAINING	10675	1
-49	! ARM, No. 3	10020	1
-50	. SHAFT, No. 2	10000	1
-51	. HOLDER, Spring, No. 4	10027	1
-52	. ARM, No. 5 reproduce	9997	1
-53	. WHEEL, Reproduce	11231	1
-53A	. SHAFT, No. 1	9999	1
-54	. BASE ARM No. 1	10001	1
-55	. SCREW, Machine ..... (10 - 32 x 1/2 '' CSKSLTDBRSNP)	COML.	1
-56	. CAPSTAN, 60 CPS	9887	1
	. CAPSTAN, 50 CPS	11516	1
-57	. SETSCREW, No. 4-40 x 1/8	COML.	1
-58	. CAM No. 3	9989	3
3-59	. SETSCREW, Socket head ..... (6 - 32 x 3/16 '' BRSNP)	COML.	3
-60	. CAM No. 5	10452	1
-61	. SETSCREW, Socket head ..... (6 - 32 x 3/16 '' BRSNP)	COML.	2
-62	. CAM No. 4	9990	1
-63	. SETSCREW, Socket head	COML.	2
-64	. SHAFT ASSY, Operational	10037	1
-65	. SPACER, Plug mounting	928	2
-66	. SCREW, Machine ..... (6 - 32 x 1 '' BDGHBRSNP)	COML.	2
-67	. WASHER, Lock, No. 6 INT'	COML.	2
-68	. CLAMP, Loop	10386	1
-69	. SCREW, Machine ..... (6 - 32 x 3/8 '' BDGHBRSNP)	COML.	1
-70	. SCREW, Machine ..... (10 - 32 x 3/8 '' BDGHBRSNP)	COML.	2
-71	. WASHER, Lock, No. 10 INT.....	COML.	2
-72	. SCREW, Machine ..... (10 - 24 x 1/2 '' CSKSLTDSST)	COML.	4
-73	. SCREW, Machine ..... (6 - 32 x 2 - 1/2 '' BDGHBRSNP)	COML.	2
-74	. SPACER, Sleeve	10464	2
-75	. BEARING, Flange	10676	1
-76	. PLATE, Bottom	10031	1

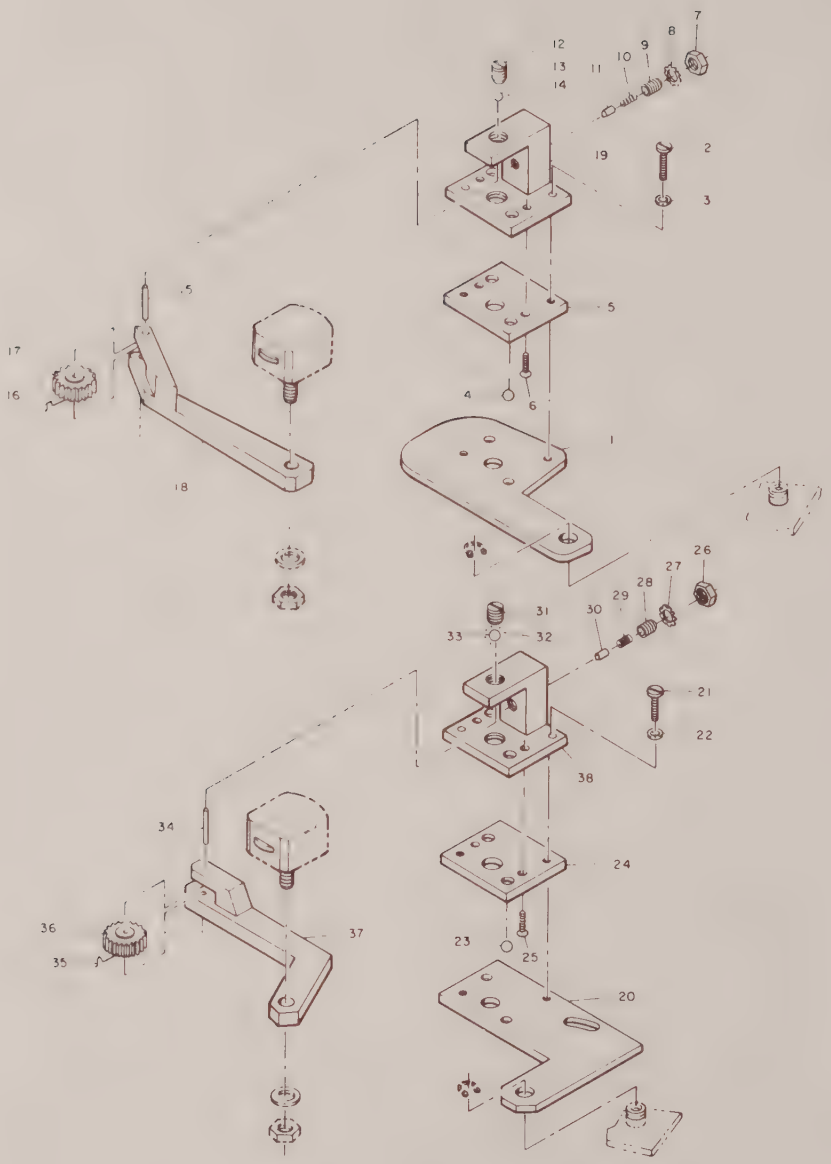


Figure 4. Record and Reproduce Head Assembly

Fig. & Index No.	Description	Part No.	Quantity
4-	* RECORD & REPRODUCE ..... HEAD ASSEMBLY	9979	1
-1	. PLATE, Erase head	9117	1
-2	. SCREW, Machine ..... (6 - 32 x 1/2 " BDGHBRSNP)	COML.	2
-3	. WASHER, Lock, No. 6 INT.	COML.	2
-4	. BALL, Bearing 5/32 DIA	7537-1	2
-5	. PLATE, Adapter	9957-1	1
-6	. SCREW, Machine ..... (4 -40 x 1/4 FHBRSNP)	COML.	2
-7	. NUT, Assembled 10 - 32	COML.	2
-8	. WASHER, Lock, No. 10 Ext.....	COML.	2
-9	. SCREW, Retainer	597	1
-10	. SPRING, Helical (comp.)	594	1
-11	. PIN, Ratchet	603	1
-12	. SCREW, 1/4 - 32 x 1/4 "	595	2
-13	. BALL, Bearing 3/64 DIA	7536	14
-14	. BALL, Bearing 5/32 DIA	7537-1	2
-15	. PIN, Straight, headless	9961	1
-16	. SPRING, Spiral, torsion	615-1	1
-17	. GEAR, Spur	598	1
-18	. ARM , Erase	9120	1
-19	. BLOCK, Mounting	9118	1
-20	. PLATE, Record head	9116	1
-21	. SCREW, Machine ..... (6 - 32 x 1/2 " BDGHBRSNP)	COML.	2
-22	. WASHER, Lock, No. 6 INT.	COML.	2
-23	. BALL, Bearing 5/32 DIA	7537-1	1
-24	. PLATE, Adapter	9957-1	1
-25	. SCREW, Machine ..... (4 - 40 x 1/4 " FHBRSNP)	COML.	2
-26	. NUT, Assembled 10 - 32	COML.	1
-27	. WASHER, Lock, No. 10 Ext	COML.	1
-28	. SCREW, Retainer	597	1
-29	. SPRING, Helical (comp.)	594	1
-30	. PIN, Ratchet	603	1
-31	. SCREW, 1/4 - 32 x 1/4 "	595	2
3-32	. BALL, Bearing 3/64 DIA	7536	14
-33	. BALL, Bearing 5/32 DIA	7537-1	2
-34	. PIN, Straight, headless	9961	1
-35	. SPRING Spiral torsion	615-1	1
-36	. GEAR, Spur	598	1
-37	. ARM, Record	9119	1
-38	. BLOCK, Mounting	9118	1

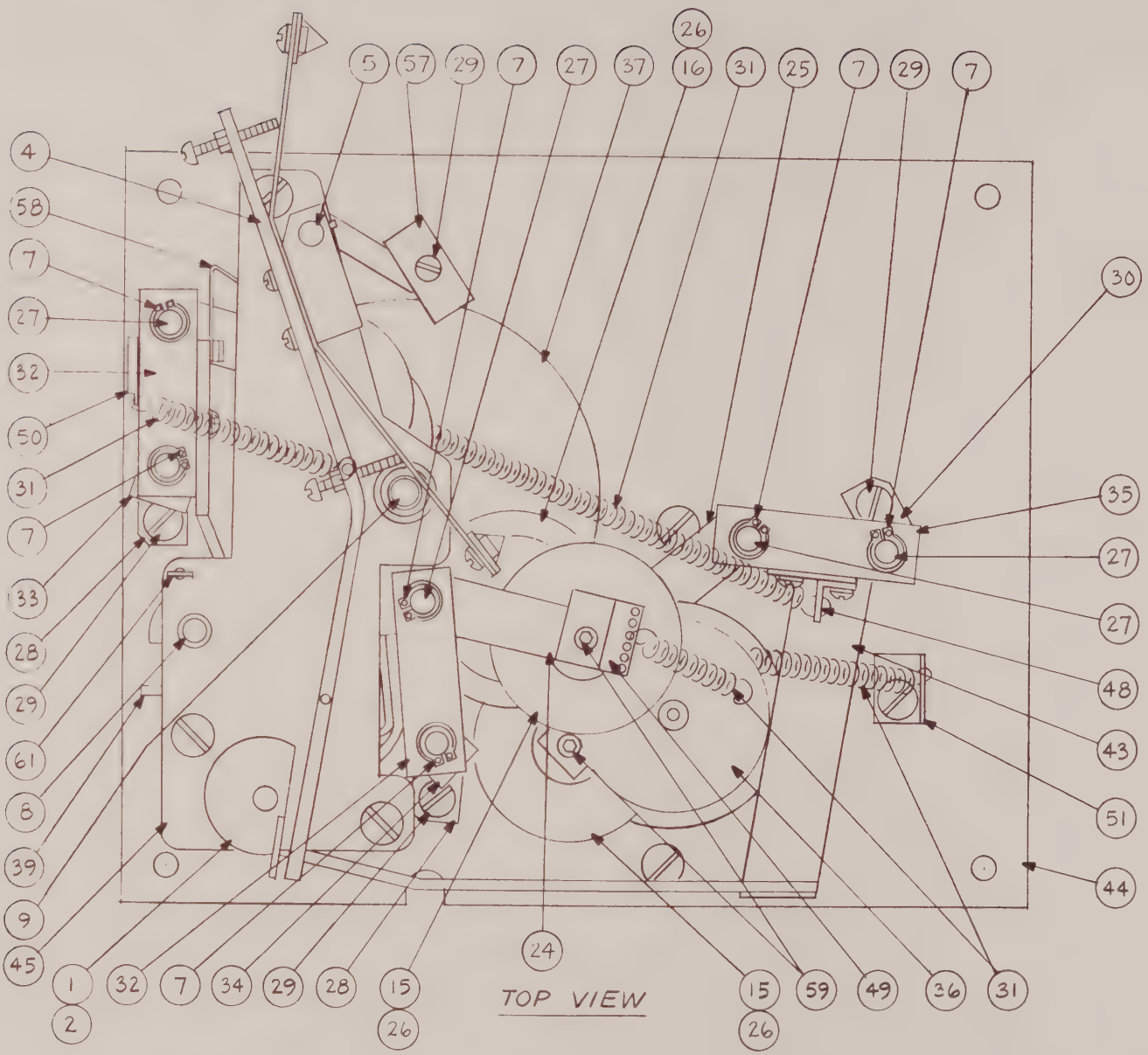


FIGURE 5 DRIVE ASSEMBLY (FOR MODELS 7029A + 7029ADC)
(SHEET 1 of 4)

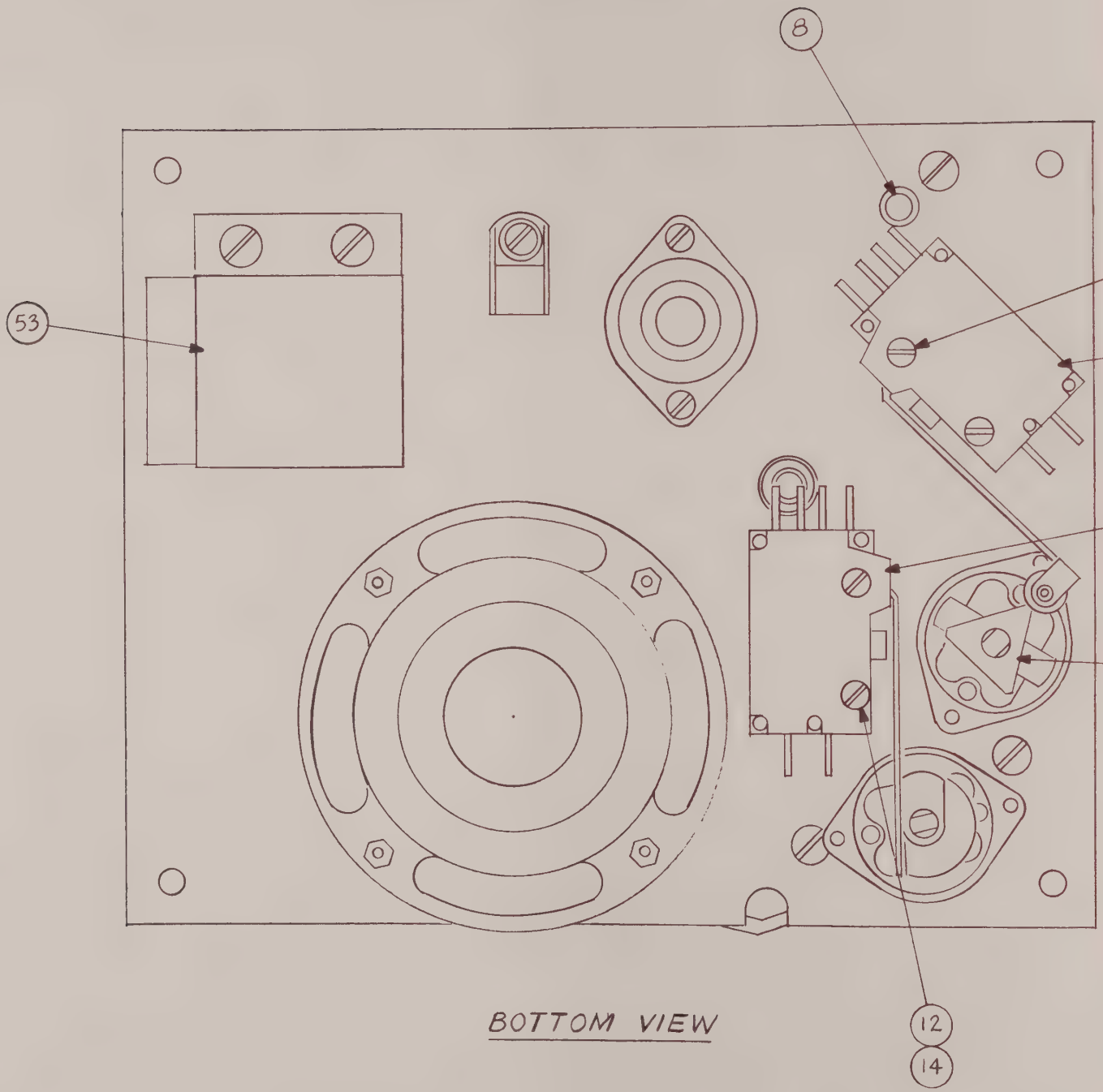


FIGURE 5 DRIVE ASSEMBLY (FOR MODELS 7029A + 7029ADC)
(SHEET 2 of 4)

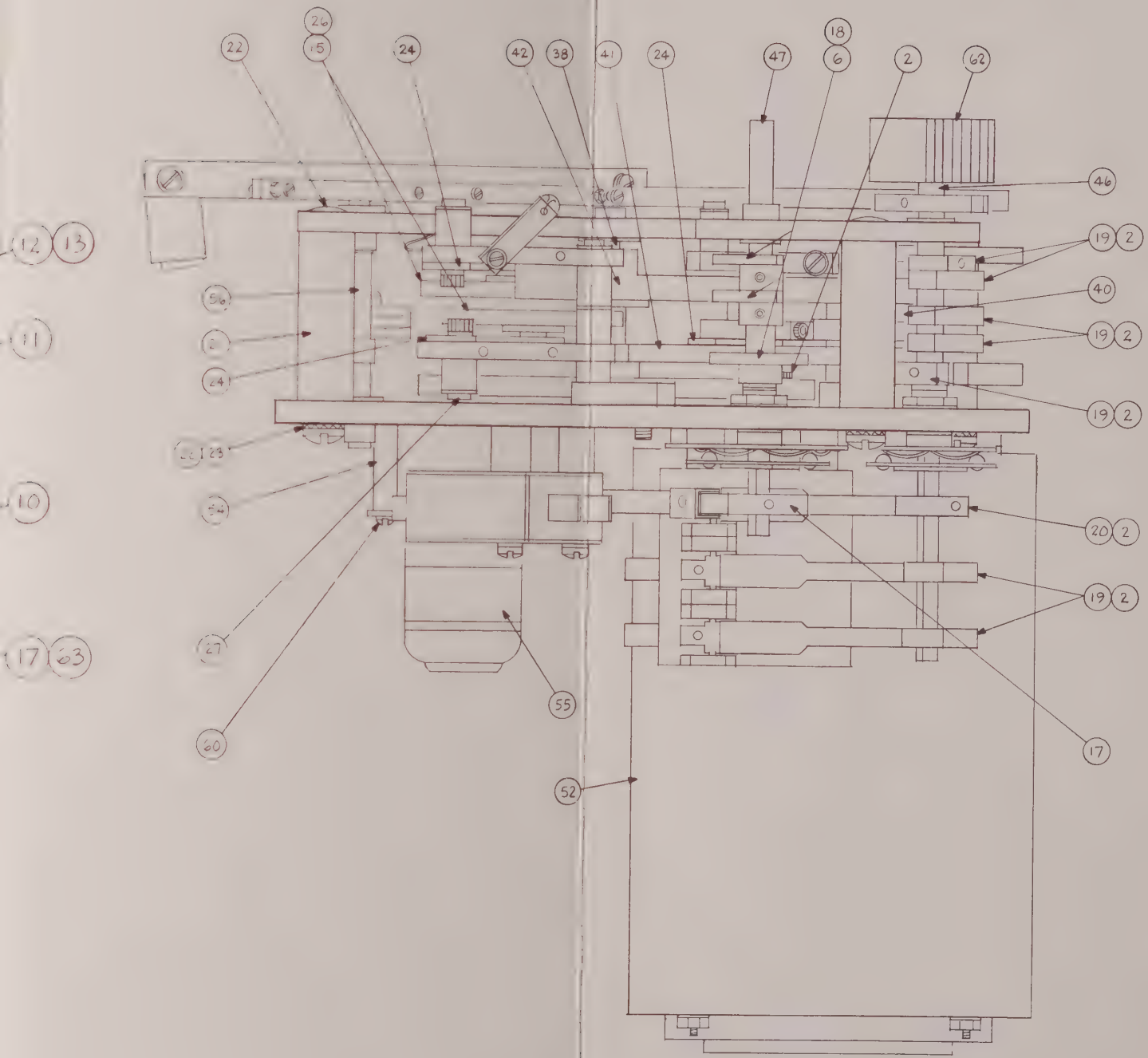


FIGURE 5 DRIVE ASSEMBLY (FOR MODELS 7029A + 7029ADC)
(SHEET 3 of 4)

Fig. & Index No.	Description	Part No.	Quantity
5-	* DRIVE ASSEMBLY, 60 CPS	9980-6	1
	50 CPS	9980-5	1
-1	. CAM, No. 7	11141	1
-2	. SETSCREW 6 - 32 x 3/16	COML.	7
-3	. SPRING, HELICAL, EXT	9744	1
	----*----		
-4	**BRAKE ARM & WIPER ASSY...	11091	1
-5	. SETSCREW 6 - 32 x 1/8	COML.	1
-6	. CAM No. 1	9884	3
-7	. RING RETAINING	10675	6
-8	. BEARING, FLANGE	10676	2
-9	. BEARING, BALL	10680	1
-10	. SWITCH, MICRO	6393-8	1
-11	. SWITCH, MICRO	6393-9	1
-12	. SPACER, SLEEVE	10464	4
-13	. SCREW, MACHINE ..... (6 - 32 x 2 1/2 BHBRNP)	COML.	2
-14	. SCREW, MACHINE ..... (6 - 32 x 1 1/4 BHBRNP)	COML.	2
-15	. WHEEL, RECORDING	9996	1
-16	. WHEEL, REPRODUCE	11231	1
-17	. CAM No. 3	9988	1
-18	. SETSCREW 4 - 40 x 3/16	COML.	3
-19	. CAM No. 3	9989	6
-20	. CAM No. 4	9990	1
-21	. SPACER	9885	4
-22	. SCREW, MACHINE ..... (10 - 32 x 3/8 BHBRNP)	COML.	9
-23	. WASHER, EXT. No. 10	COML.	8
-24	. ARM No. 5	9997	3
-25	. ARM No. 6	9998	1
-26	. SHAFT, No. 1	9999	3
-27	. SHAFT, No. 2	10000	7
-28	. BASE ARM No. 1	10001	2
-29	. SCREW, MACHINE ..... (10 - 32 x 1/2 BHBRNP)	COML.	4
-30	. BASE ARM No. 2	10002	1
-31	. SPRING, HELICAL, EXT	9743	3
-32	. ARM & BEARING ASSY No. 1..	10018	2
-33	. ARM & BEARING ASSY No. 2..	10019	1
-34	. ARM & BEARING ASSY No. 3..	10020	1
-35	. ARM & BEARING ASSY No. 4..	10021	1
5-36	. CAPSTAN, 60 CPS	9887	1
	. CAPSTAN, 50 CPS	11516	1
-37	. WHEEL, REDUCTION	9992	1
-38	. WHEEL, HUBBED	9993	1
-39	. ARM No. 1	10022	1
-40	. ARM No. 2	10023	1
-41	. ARM No. 3	10024	1
-42	. ARM No. 4	10025	1
-43	. ARM No. 5	10026	1
-44	. PLATE, BOTTOM	10031	1
-45	. PLATE, TOP	10032	1
-46	. SHAFT ASSY., OPERATIONAL.	10037	1
-47	. SHAFT, SPEED CONTROL.....	10038	1
-48	. BRACKET, SPRING MTG	9994	1

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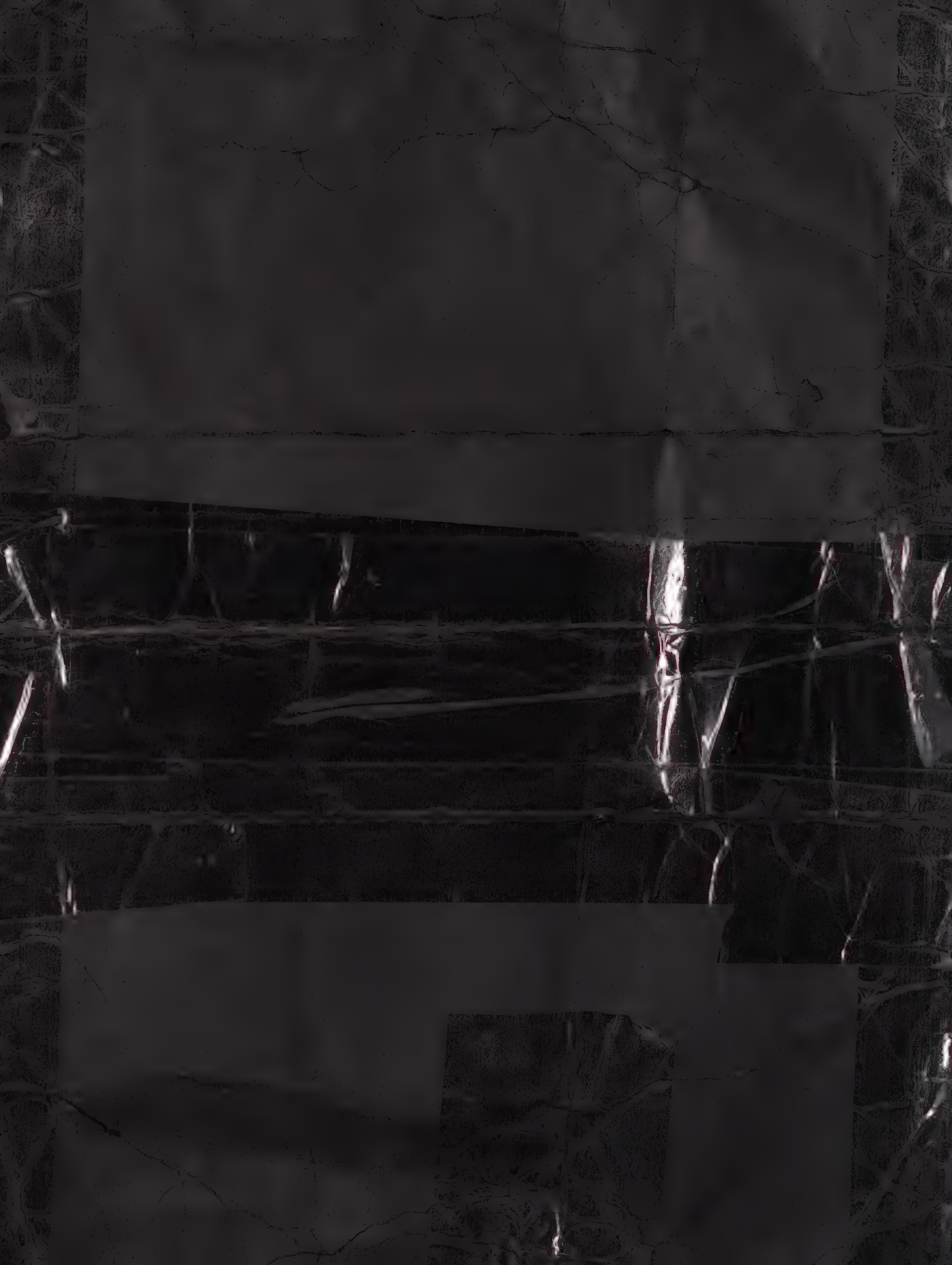
Fig & Index No.	Description	Part No.	Quantity
-49	. HOLDER, SPRING No. 1 ...	10027	1
-50	. HOLDER, SPRING No. 2...	10028	1
-51	. HOLDER, SPRING No. 3...	10029	1
-52	. MOTOR ASSY' 60 CPS	9978	1
	50 CPS.....	11517	1
-53	. CAPACITOR, MOTOR ..... (6uf 220VAC)	10181	1
-54	. SPACER, PLUG MTG.	928	4
-55	. SOCKET, MOTOR PLUG ...	253	1
-56	. SHAFT ASSY., BRAKE	10146	1
-57	. SHOE, BRAKE, LEATHER ..	10149	1
-58	. SPRING, ANTI-CHATTER ..	9991	1
-59	. SCREW, MACHINE 8-32 x 1/4.	COML.	2
-60	. SCREW, MACHINE 6-32 x 1 ..	COML.	4
-61	. HOLDER, SPRING	9745	1
-62	. KNOB, POINTER	4927	1
-63	. SET SCREW, 4 - 40 x 1/8 ...	COML.	1
-64	. WIPER ASSY	11090-3	2
-65	. SPRING ARM, WIPER	11089	1
-66	. BRACKET, BRAKE	10147	1
-67	. ARM, CONTROL BRAKE	11136	1
-68	. SCREW MACHINE 4 - 40 x 7/8	COML.	2
-69	. WASHER, LOCK No. 4	COML.	4
-70	. NUT, ASSEMBLED 4-40	COML.	2
-71	. SCREW MACHINE ..... (4 - 40 x 3/16 BDBRNP)	COML.	2
-72	. SCREW MACHINE ..... (4 - 40 x 3/8 RHBRNP)	COML.	2



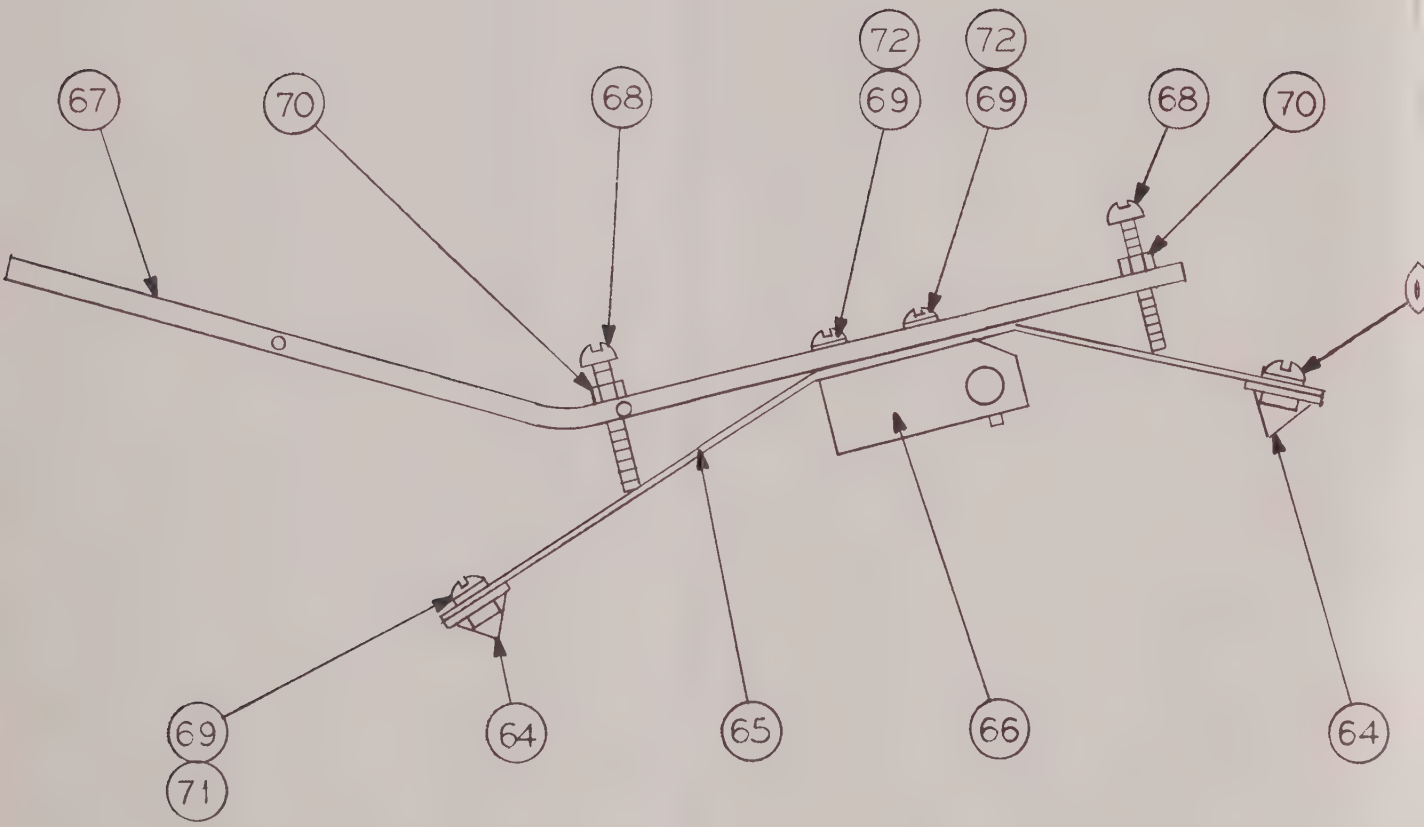


FIGURE 5 DRIVE ASSEMBLY (FOR MODELS 7029A + 7029ADC)
(SHEET 4 of 4)

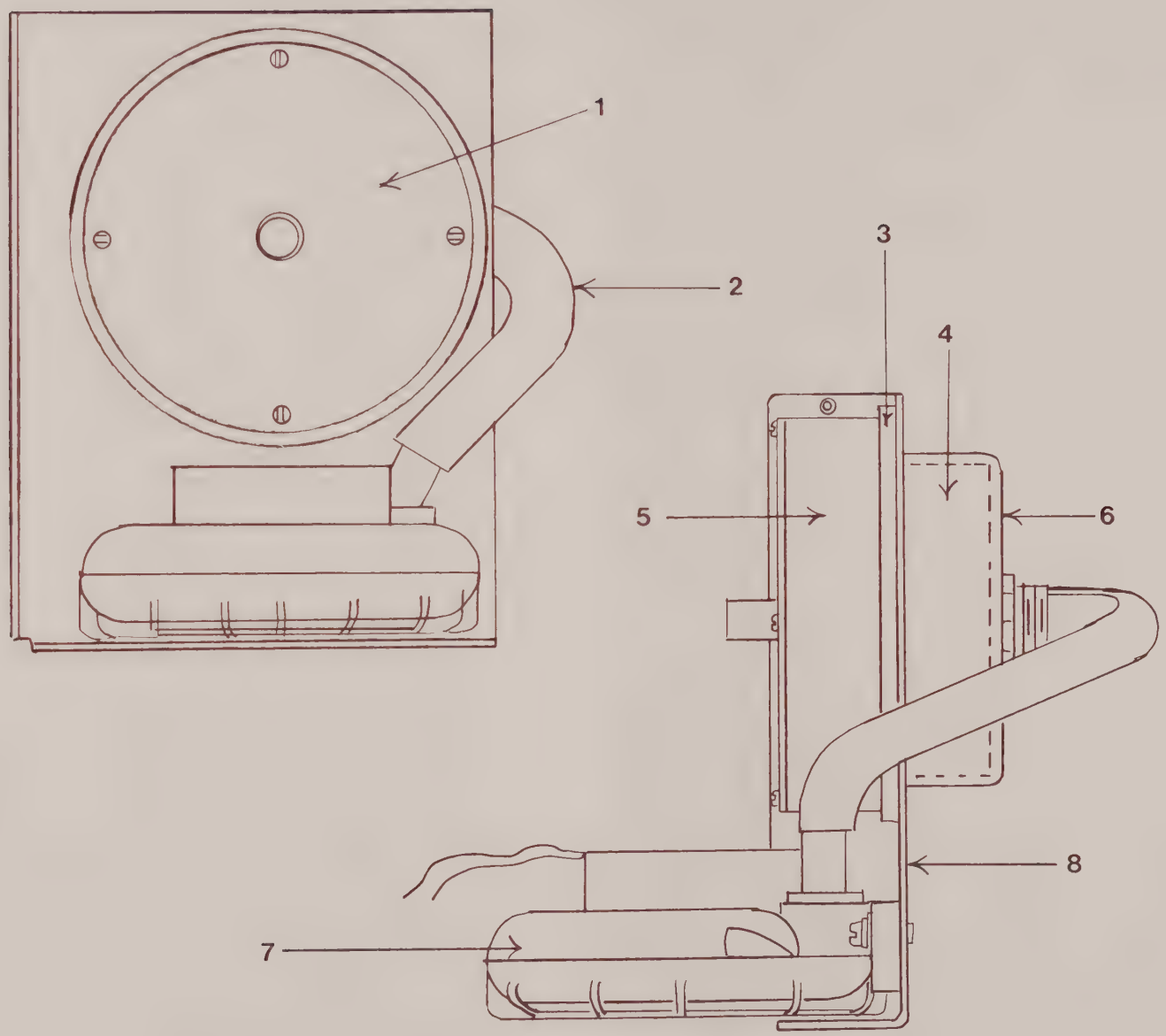


FIGURE 6 AIR FILTER ASSY (NEW TYPE)

Fig. & Index No.	Description	Part No.	Quantity
6-	* AIR FILTER ASSY	13763	1
-1	. END CAP	13783	1
-2	. HOSE COUPLING	7436-4	1
-3	. RING RETAINING	13781	1
-4	. FILTER CARTRIDGE	7021-7	1
-5	. FILTER TUBE	13782	1
-6	. FILTER CARTRIDGE ASSY	7021-5	1
-7	. BLOWER MOTOR	13762	1
-8	. BRACKET, MTG	13765	1

SECTION 6C

6070A

PARTS LIST, CONTOUR DISPLAY MODEL 6070

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
Detector / Filter Assy.		14113 **	K.E.C.
CAPACITORS:			
C10	3pf, Feed thru	1996 **	Cambion 570-1990-01-00
C11	.15μf, 50V, Mylar-paper	6411-23	TRW - 601 PE
C12	same as C11		
C15	same as C10		
COIL:			
L1	5.2hy, choke	9100-0049	Magnetic Circuits OB50-FL34
RESISTORS:			
R17	3.3K ohm, ½w, 10% tol.	3321-E **	Allen Bradley EB3321
	P.C. Board Assy.	9497W **	K.E.C.
	P.C. Board Only	9497 **	K.E.C.
CAPACITORS:			
C1	.01μf, 100V, Mylar-paper	6899-12 **	Elmenco 1DP-1-103
C2 & C3	same as C1		
C4	10μf, 25V, electrolytics	0180-0027	GE 76F02KD100
C5	same as C4		
C6	2μf, 50V, electrolytics	0180-0048	GE 76F2LC2R0
C7*	750μf, 500V, Mica	6359-67 **	Elmenco DM-15-751
C8	500μf, 500V, Mica	6359-66 **	Elmenco DM-15-501
C9	same as C8		
* factory selected			
DIODES:			
D1	1N 127A, GER.	1910-0004	G.E. 127A
D2	same as D1		
TRANSISTORS:			
Q1	2N3859	1854-0011	GE 2N3859
Q2	2N3569	1854-0010	Fairchild 2N3569
Q3	2N3440	1854-0205	RCA 2N3440
Q4	same as Q3		
Q5	2N4889	1853-0003	Fairchild 2N4889
Q34	same as Q2		
RESISTORS:			
R1	10K ohm, ½w, 10% tol.	1031-E **	Allen Bradley EB1031
R2	6.2K ohm, ½w, 5% tol.	6225-E **	Allen Bradley EB6225
R3	750 ohm, ½w, 5% tol.	7515-E **	Allen Bradley EB7515
R4	same as R3		
R5	30K ohm, ½w, 5% tol.	3035-E **	Allen Bradley EB3035
R6	47K ohm, ½w, 10% tol.	4731-E **	Allen Bradley EB4731
R7	same as R5		
R8	same as R6		
R9	22K ohm, ½w, 10% tol.	2231-E **	Allen Bradley EB2231
R10	30 ohm, ½w, 5% tol.	3005-E **	Allen Bradley EB3005
R11	270 ohm, ½w, 10% tol.	2711-E **	Allen Bradley EB2711
R12	same as R11		
R13	same as R10		
R14	22 ohm, ½ w, 5% tol.	2205-E **	Allen Bradley EB2205
R15	same as R6		
R16	220K ohm, ½w, 5% tol.	2245-E **	Allen Bradley EB2245
R159	120K ohm, ½w, 10% tol.	1241-E **	Allen Bradley EB1241
R160	15K ohm, ½w, 10% tol.	1531-E **	Allen Bradley EB1531
R163	51K ohm, ½w, 5% tol.	5135-E **	Allen Bradley EB5135
R164	22K ohm, ½w, 10% tol.	2231-E **	Allen Bradley EB2231
TRANSFORMERS:			
T3	Transformer	9632 **	K.E.C.

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
	P.C. Board Ass'y	9498-W **	K.E.C.
	P.C. Board	9498 **	K.E.C.
CAPACITORS:			
C16	50μf, 25V, electrolytic	0180-0030	GE 76F92KF500
C17	.1μf, 100V,	6899-11 **	Elmenco 1DP-2-104
C18	.001μf, 600V	6899-10 **	Elmenco 6DP-1-102
C19	same as C18		
C56	500μf, 300V	6359-66 **	Elmenco DM-15-501
C57	same as C56		
DIODES:			
D3	FD 333	1901-0004	Fairchild FD 333
D4	same as D3		
D5 thru D16	same as D3		
TRANSISTORS:			
Q6	2N3859	1854-0011	GE 2N3859
Q7	2N2483	1854-0002	Fairchild 2N2483
Q8	same as Q7		
Q9	2N4889	1853-0003	Fairchild 2N4889
Q10	2N3440	1854-0205	RCA 2N3440
Q11	same as Q10		
Q12 & Q13	same as Q10		
RESISTORS:			
R19	200K ohm, ¼w, 1% tol.	6558-353 **	T.I. RN60D
R20	120K ohm, ½w, 10% tol.	1241-E **	Allen Bradley EB1241
R21	3.16K ohm, ¼w, 1% tol.	6558-284 **	T.I. RN60D
R22	48.7K ohm, ¼w, 1% tol.	6558-351 **	T.I. RN60D
R23	2K ohm, Pot	2100-0069	Beckman 78PR2K
R24	2.32K ohm, ¼w, 1% tol.	6558-355 **	T.I. RN60D
R25	12.1K ohm, ¼w, 1% tol.	6558-356 **	T.I. RN60D
R26	same as R25		
R27	210 ohm, ¼w, 1% tol.	6558-357 **	T.I. RN60D
R28	same as R25		
R29	same as R27		
R30	same as R21		
R31	33.2K ohm, ¼w, 1% tol.	6558-358 **	T.I. RN60D
R32	681 ohm, ¼w, 1% tol.	6558-359 **	T.I. RN60D
R33	1.82K ohm, ¼w, 1% tol.	6558-360 **	T.I. RN60D
R34	10K ohm, ¼w, 1% tol.	6558-278 **	T.I. RN60D
R35	1K ohm, ½w, 10% tol.	1021-E **	Allen Bradley EB1021
R36	same as R34		
R37	same as R35		
R38	27K ohm, ½w, 10% tol.	2731-E **	Allen Bradley EB2731
R39	33K ohm, ½w, 10% tol.	3331-E **	Allen Bradley EB3331
R40	8.2K ohm, 1w, 10% tol.	8221-G **	Allen Bradley GB8221
R41	49.9K ohm, ½w, 1% tol.	6558-361 **	T.I. RN65D
R42	200K ohm, ¼w, 1% tol.	6558-353 **	T.I. RN60D
R43	12.7K ohm, ½w, 1% tol.	6558-362 **	T.I. RN65D
R44	27.4K ohm, ½w, 1% tol.	6558-363 **	T.I. RN65D
R45	same as R42		
R46	33.2K ohm, ½w, 1% tol.	6558-364 **	T.I. RN65D
R47	10.2K ohm, ½w, 1% tol.	6558-365 **	T.I. RN65D
R48	23.7K ohm, ½ w, 1% tol.	6558-366 **	T.I. RN65D
R49	same as R42		
R50	6.81K ohm, ½w, 1% tol.	6558-367 **	T.I. RN65D
R51	8.87K ohm, ½w, 1% tol.	6558-368 **	T.I. RN65D
R52	23.2K ohm, ½w, 1% tol.	6558-369 **	T.I. RN65D
R53	same as R42		
R54	2.8K ohm, ½w, 1% tol.	6558-370 **	T.I. RN65D
R55	7.87K ohm, ½w, 1% tol.	6558-371 **	T.I. RN65D
R56	22.1K ohm, ½w, 1% tol.	6558-372 **	T.I. RN65D
R57	same as R42		
R58	1.87K ohm, ½ w, 1% tol.	6558-373 **	T.I. RN65D

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
R59	2.05K ohm, ½w, 1% tol.	6558-374 **	T.I. RN65D
R60	21.5K ohm, ½w, 1% tol.	6558-375 **	T.I. RN65D
R61	same as R42		
R62	619 ohm, ½w, 1% tol.	6558-376 **	T.I. RN65D
R63	1.54K ohm, ½w, 1% tol.	6558-377 **	T.I. RN65D
R64	20.5K ohm, ½w, 1% tol.	6558-378 **	T.I. RN65D
R65	same as R42		
R66	280 ohm, ½w, 1% tol.	6558-379 **	T.I. RN65D
R67	same as R63		
R68	same as R42		
R69	274 ohm, ½w, 1% tol.	6558-380 **	T.I. RN65D
R70	4.02 K ohm, ½w, 1% tol.	6558-292 **	T.I. RN65D
	P.C. Board Ass'y	9496-W **	K.E.C.
	P.C. Board	9496	K.E.C.
CAPACITORS:			
C20	.05μf, 100V, Mylar-paper	6899-1 **	Elmenco 1DP-2-503
C21	same as C20		
C22 thru C25	same as C20		
C26	.01μf, 100V, Mylar-paper	6899-12 **	Elmenco 1DP-1-103
C27	.001μf, 100V		
C28	500pf, 300V	6359-66 **	Elmenco DM-15-501
C29	.2μf, 100V, ceramic disc	0150-0013	Erie 8131-100-651-204Z
C45	50μf, 25V, electrolytic	0180-0030	GE 76F2KF500
DIODES :			
D17	FD333	1901-0004	Fairchild FD333
D18 thru D22	same as D17		
CHOKES:			
L5	50mh, choke	9100-0044	Caddell-Burns 1670-8
TRANSISTORS:			
Q14	2N3440	1854-0205	RCA 2N3440
Q15	2N3568	1854-0009	Fairchild 2N3568
Q16	2N3859	1854-0011	GE 2N3859
RESISTORS:			
R71	Not used		
R72	27K ohm, ½w, 10% tol.	2731-E **	Allen Bradley EB2731
R73	10K ohm, ½w, 10% tol.	1031-E **	Allen Bradley EB1031
R74	20K ohm, ½w, 5% tol.	2035-E **	Allen Bradley EB2035
R75	22K ohm, ½w, 10% tol.	2231-E **	Allen Bradley EB2231
R76	same as R75		
R77	4.7K ohm, ½w, 10% tol	4721-E **	Allen Bradley EB4721
R78	270K ohm, ½w, 10% tol.	2741-E **	Allen Bradley EB2741
R79	68K ohm, ½w, 10% tol.	6831-E **	Allen Bradley EB6831
R80	620 ohm, ½w, 5% tol.	6215-E **	Allen Bradley EB6215
R81	1.8K ohm, ½w, 10% tol.	1821-E **	Allen Bradley EB1821
R82	6.2K ohm, ½w, 5% tol.	6225-E **	Allen Bradley EB6225
R83	8.25K ohm, ¼w, 1% tol.	6558-381 **	T.I. RN60D
R84	1.5K ohm, ¼w, 1% tol.	6558-382 **	T.I. RN60D
R85	12K ohm, ½w, 10% tol.	1231-E **	Allen Bradley EB1231
R86	same as R83		
R87	3.32K ohm, ¼w, 1% tol.	6558-383 **	T.I. RN60D
R88	same as R73		
R89	4.32K ohm, ¼w, 1% tol.	6558-384 **	T.I. RN60D
R90	3.83K ohm, ¼w, 1% tol.	6558-385 **	T.I. RN60D
R91	6.8K ohm, ½w, 10% tol.	6821-E **	Allen Bradley EB6821
R92	2K ohm, ¼w, 1% tol.	6558-293 **	T.I. RN60D
R93	6.81K ohm, ¼w, 1% tol.	6558-386 **	T.I. RN60D
R94	5.6K ohm, ½w, 10% tol.	5621-E **	Allen Bradley EB5621
R95	12.1K ohm, ¼w, 1% tol.	6558-356 **	T.I. RN60D
R96	same as R83		
R97	1.5K ohm, ½w, 10% tol.	1521-E **	Allen Bradley EB1521
R98	6.49K ohm, ¼w, 1% tol.	6558-387 **	T.I. RN60D
R99	18.7K ohm, ¼w, 1% tol.	6558-388 **	T.I. RN60D
R129	same as R77		

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
	P.C. Board Ass'y	9499-W	K.E.C.
	P.C. Board	9499	K.E.C.
CAPACITORS:			
C30	10μf, 25V, electrolytic	0180-0027	G.E. 76F92KD100
C31	2μf, 50V, electrolytic	0180-0048	G.E. 76F92LC2R0
C32	.01μf, 400V	6899-8 **	Elmenco 4DP-1-103
C34 thru C39	same as C31		
C33	.001μf, 600V	6899-10 **	Elmenco 6DP-1-102
C40	same as C30		
C41	.003μf, 600V	6899-15 **	Elmenco 6DP-1-302
C42	same as C31		
C43	.0075μf, 100V, Mylar	6899-19 **	Elmenco 1DP-1-752
C44	same as C30		
C45	not used		
C46	680pf, 500V, mica	6359-80 **	Elmenco DM16-680
C47	same as C46		
DIODES:			
D23	1N3067, Silicon	1901-0014	Fairchild 1N3067
D24	1N457, Silicon	1901-0006	T.I. 1N457
D25	same as D24		
D26	same as D24		
COILS:			
L3	680mh	6394-50 **	National Radio B17303
TRANSISTORS:			
Q17	2N3859	1854-0011	GE 2N3859
Q18	2N1377	1853-0001	Texas 2N1377
Q19 thru Q23	same as Q17		
Q24	2N3563	1854-0108	Fairchild 2N3563
Q25	same as Q24		
RESISTORS:			
R100	3K ohm, ½w, 5% tol.	3035-E **	Allen Bradley EB3035
R101	4.7K ohm, ½w, 10% tol.	4721-E **	Allen Bradley EB4721
R102	39K ohm, ½w, 10% tol.	3931-E **	Allen Bradley EB3931
R103	330 ohm, ½w, 10% tol.	3311-E **	Allen Bradley EB3311
R104	3.3K ohm, ½w, 10% tol.	3321-E **	Allen Bradley EB3321
R105	220 ohm, ½w, 10% tol.	2211-E **	Allen Bradley EB2211
R106	same as R103		
R107	same as R104		
R108	22K ohm, ½w, 10% tol.	2231-E **	Allen Bradley EB2231
R109	1.5K ohm, ½w, 10% tol.	1521-E **	Allen Bradley EB1521
R110	100K ohm, ½w, 10% tol.	1041-E **	Allen Bradley EB1041
R111	same as R110		
R112	210K ohm, ¼w, 1% tol.	6558-389 **	Texas Instruments RN60D
R113	6.81K ohm, ¼w, 1% tol.	6558-386 **	Texas Instruments RN60D
R114	82K ohm, ½w, 10% tol.	8231-E **	Allen Bradley EB8231
R115	3.3K ohm, ½w, 10% tol.	3321-E **	Allen Bradley EB3321
R116	6.8K ohm, ½w, 10% tol.	6821-E **	Allen Bradley EB6821
R117	100K ohm, ½w, 10% tol.	1041-E **	Allen Bradley EB1041
R118	same as R117		
R119	same as R112		
R120	same as R115		
R121	same as R116		
R122	62K ohm, ½w, 5% tol.	6235-E **	Allen Bradley EB6235
R123	same as R115		
R124	6.81K ohm, ¼w, 1% tol.	6558-386 **	Texas Instrument RN60D
R125	same as R115		
R126	220K ohm, ½w, 10% tol.	2241-E **	Allen Bradley EB2241
R127	47K ohm, ½w, 10% tol.	4731-E **	Allen Bradley EB4731
R128	10K ohm, ½w, 10% tol.	1031-E **	Allen Bradley EB1031
R131	same as R128		
R132	510 ohm, ½w, 5% tol.	5115-E **	Allen Bradley EB5115
R133	10K ohm, ¼w, 1% tol.	6558-281 **	Texas Instrument RN60D

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
RESISTORS CONTINUED:			
R134	same as R133		
R135	620 ohm, ½w, 5% tol.	6215-E **	Allen Bradley EB6215
R138	27 ohm, ½w, 10% tol.	2701-E **	Allen Bradley EB2701
R161	430 ohm, ½w, 5% tol.	4315-E	Allen Bradley EB4315
R162	same as R135		
	P.C. Board Assy	9500-W **	K.E.C.
	P.C. Board	9500 **	K.E.C.
CAPACITORS:			
C50	10µf, 150V, electrolytic	0180-0067	Sprague TVA1406
C51	250µf, 50V, electrolytic	0180-0057	Cornell Dubiler BR250-50
C52	same as C50		
C54	same as C51		
C55	150µf, 150V, electrolytic	0180-0070	Cornell Dubiler BR150-150
DIODES:			
D27	F6		
D28 & D29	same as D27		
D30	1N4742, zener	1902-0029	Motorola 1N4742
D31	1N4736, zener	1902-0026	Motorola 1N4736
D32	same as D27		
D33	same as D27		
D34 thru D40	same as D27		
D41	1N3046B, zener	1902-0011	Motorola 1N3046B
TRANSISTORS:			
Q26	2N1701	1854-0202	RCA - 2N1701
Q27	2N3859	11-0011	GE 2N3859
Q28	2N3569	11-0010	Fairchild 2N3569
Q29	same as Q28		
Q30	same as Q28		
Q31	2N2270	1854-0004	RCA 2N2270
Q32	same as Q27		
Q33	2N3440	1854-0205	RCA 2N3440
RESISTORS:			
R139	15K ohm, ½w, 10% tol.	1531-E **	Allen Bradley EB1531
R140	5.6K ohm, ½w, 10% tol.	5621-E **	Allen Bradley EB5621
R141	12K ohm, ½w, 10% tol.	1231-E **	Allen Bradley EB1231
R142	27.4K ohm, ¼w, 1% tol.	6558-363 **	T.I. RN60D
R143	2K ohm, Pot	9122-122 **	Beckman 77PR2K
R144	6.81K ohm, ¼ w, 1% tol.	6558-367 **	T.I. RN60D
R145	68K ohm, ½w, 10% tol.	6831-E **	Allen Bradley EB6831
R146	75K ohm, ¼w, 1% tol.	6558-390 **	T.I. RN60D
R147	same as R144		
R148	3.3K ohm, ½w, 10% tol.	3321-E **	Allen Bradley EB3321
R149	18K ohm, ½w, 10% tol.	1831-E **	Allen Bradley EB1831
R150	same as R149		
R151	same as R144		
R152	same as R143		
R153	same as R142		
R154	120 ohm, ½w, 10% tol.	1211-E **	Allen Bradley EB1211
R155	22 ohm, ½w, 10% tol.	2201-E **	Allen Bradley EB2201
R156	330 ohm, ½w, 10% tol.	3311-E **	Allen Bradley EB3311
R157	47K ohm, ½w, 10% tol.	4731-E **	Allen Bradley EB4731
R158	120K ohm, ½w, 10% tol.	1241-E **	Allen Bradley EB1241
	Unit Ass'y	6070A	
CAPACITORS:			
C48	2µf, 50V, electrolytic	0180-0048	GE 76F02LC2R0
C49	150µf, 25V, electrolytic	0180-0034	GE 76F92KM151
C53	35µf, 50V, electrolytic	0180-0052	GE 76F02LK350

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
CAPACITORS CONTINUED:			
C59	150μf, 25V, electrolytic	0180-0034	GE 76F92KM151
C61	.05μf, 100V, Mylar-paper	6899-1 **	Elmenco 1DP-2-503
LAMPS:			
I1	Pilot Light		Dialight 137-8836-937
COILS:			
L4	.5mh, choke	9100-0029	C-Burns 1670-2
CONNECTORS:			
P6	Plug, 15 Pin Female	6909-117 **	Amphenol 17-10150
P7	Plug, 24 pin	6909-139 **	Amphenol 26-159-24
PJ1	Connector, 15 pin	1250-0063	Amphenol 143-015-01
PJ2	Connector, 10 pin	1250-0062	Amphenol 143-010-01
PJ3	same as PJ1		
PJ4	same as PJ1		
PJ5	same as PJ1		
RESISTORS:			
R71	2.2K ohm, ½w, 10% tol.	2221-E **	Allen Bradley EB-2221
R130	5K ohm, Pot	9122-152 **	AB 70A4N0485502U
R136	100 ohm, Pot	9122-162 **	AB 70A4N048S5101U
R137	470 ohm, ½w, 10% tol.	4711-E **	Allen Bradley EB4711
SWITCH:			
S1	Rotary Switch, 1 wafer, 2pos.	176 **	K.E.C.
TRANSFORMERS:			
T1	Transformer, Power	9105-0009	Berkshire 8195
T2	Transformer	9105-0022	Stancor PS8415

SECTION 6D

6076C

DWG. SYM. No	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
CAPACITORS:			
C1101	2μf, 50V, electrolytic	0180-0048	GE76F92LC2R0
C1102	.05μf, 100V, Mylar-paper	6899-1 **	Elmenco 1DP-2-503
C1103	10μf, 25V, electrolytic	0180-0027	GE76F92KD100
C1104	same as C1103		
C1105	.22μf, 50V, Mylar	6411-1 **	TRW - 601PE
C1106	same as C1101		
C1107	50μf, 12V	0180 - 0011	GE76F92EE500
C1108	same as C1101		
C1109	same as C1107		
C1110 & C1111	same as C1105		
C1112	same as C1102		
C1113	.02μf, 100V, mylar-paper	6899-13 **	Elmenco 1DP-1-203
C1114	.001μf, 600V. mylar-paper	6899-10 **	Elmenco 6DP-1-102
C1115 &C1116	same as C1102		
C1117 & C1118	250μf, 50V, electrolytic	0180-0057	Cornell Dubilier BR 250-50
C1119	1μf, 50V, electrolytic	0180-0047	GE76F92LC1R0
C1120	.003μf, 600V, mylar-paper	6899-15 **	Elmenco 6DP-1-302
C1121	same as C1102		
C1122	150μf, 25V, electrolytic	0180-0034	GE76F92KM151
C1123	same as C1113		
C1124	V100A, Varicap	6357-84 **	Pacific Semiconductor
C1125	same as C1124		
C1126	.001μf, 100V, ceramic	6360-60 **	Erie 8101-100-651-1022
DIODES:			
D1101	1N4732, Zener	1902-0022	Motorola 1N4732
D1102	1N3067, silicon	1901-0014	Fairchild 1N3067
D1103	same as D1101		
D1104 - D1106	same as D1102		
D1107 & D1108	not used		
D1109	1N4733, Zener	1902-0023	Motorola 1N4733
D1110	1N4740, Zener	1902-0028	Motorola 1N4740
D1111	1N4744, Zener	1902-0031	Motorola 1N4744
D1112	Not Used		
D1113	F6, Silicon	1908-0007	Sarkes Tarzian F6
D1114	same as D1113		
D1115	1N4736, Zener	1902-0026	Motorola 1N4736
TRANSISTORS:			
Q1101	2N3859	1854-0011	RCA 2N3859
Q1102	same as Q1101		
Q1103 & Q1104	2N2270	1854-0004	RCA 2N2270
Q1105 - Q1107	same as Q1101		
Q1108	same as Q1103		
Q1109	same as Q1101		
Q1110	2N1701	1854-0202	RCA 2N1701
Q1111	same as Q1101		
RESISTORS			
R1101	6.8K ohm, ½w, 10% tol.	6821-E **	Allen Bradley EB 6821
R1102	10K ohm, ½w, 10% tol.	1031-E **	Allen Bradley EB 1031
R1103	82K ohm, ½w, 10% tol.	8231-E **	Allen Bradley EB 8231
R1104	27K ohm, ½w, 10% tol.	2731-E **	Allen Bradley EB 2731
R1105	18K ohm, ½w, 10% tol.	1831-E **	Allen Bradley EB 1831
R1106	4.7K ohm, ½w, 10% tol.	4721-E **	Allen Bradley EB 4721
* R1107	220 ohm, ½w, 10% tol.	2211-E **	Allen Bradley EB 2211
R1108	1K ohm, ½w, 10% tol.	1021-E **	Allen Bradley EB 1021
R1109	same as R1105		
R1110	same as R1101		
R1111 & R1112	470 ohm, ½w, 10% tol.	4711-E **	Allen Bradley EB 4711
R1113	same as R1102		
R1114	same as R1108		
R1115	2.7K ohm, ½w, 10% tol.	2721-E **	Allen Bradley EB 2721
R1116	39 ohm, ½w, 10% tol.	3901-E **	Allen Bradley EB 3901
R1117	390 ohm, ½w, 10% tol.	3911-E **	Allen Bradley EB 3911
R1118	same as R1104		
R1119	same as R1102		
R1120	same as R1108		

DWG. SYM. NO.	DESCRIPTION	KAY PART NO.	MANUFACTURER & PART NO.
R1121	same as R1111		
R1122	2K, Pot, Trimpot	9122-165 **	Beckman 89WR2K
R1123	same as R1116		
R1124	same as R1117		
R1125	same as R1104		
R1126	7.5K, ½w, 5% tol.	7525-E **	Allen Bradley EB7525
R1127	same as R1105		
R1128	same as R1102		
R1129	10K, pot	2100-0099	Allen Bradley SV1031
R1130	3.16K ohm, ¼w, 1% tol.	6558-284 **	Mepco RN60D 3.16K
R1131	12.1K oh, ¼w, 1% tol.	6558-285 **	Mepco RN60D 12.1K
R1132	33K ohm, ½w, 10% tol.	3331-E **	Allen Bradley EB3331
R1133	470K ohm, ½w, 5% tol.	4745-E **	Allen Bradley EB4745
R1134	68K ohm, ½w, 10% tol.	6831-E **	Allen Bradley EB6831
R1135	same as R1134		
R1136	8.2K ohm, ½w, 10% tol.	8221-E **	Allen Bradley EB8221
R1137	same as R1111		
R1138	same as R1115		
R1139	same as R1134		
R1140	same as R1136		
R1141	3.9K ohm, ½w, 10% tol.	3921-E **	Allen Bradley EB3921
R1142	820 ohm, ½w, 10% tol.	8211-E **	
R1143	same as R1141		
R1144	220 ohm, ½w, 10% tol.	2211-E **	Allen Bradley EB2211
R1145	same as R1106		
R1147	same as R1115		
R1149	same as R1115		
R1151	10 ohm, ½w, 10% tol.	1001-E **	Allen Bradley EB1001
R1154	same as R1101		
R1155	same as R1108		
R1158	128 ohm, ¼w, 1% tol.	6558-30 **	United Mineral Corp. LCA-0309
R1161	100 ohm, ½w, 10% tol.	1011-E **	Allen Bradley EB1011
R1162	same as R1102		
R1163	120 ohm, 1w, 10% tol.	1211-G **	Allen Bradley GB 1211
R1164	15K ohm, ½w, 10% tol.	1531-E **	Allen Bradley EB1531
R1165	1.5K ohm, 1w, 10% tol.	1521-G **	Allen Bradley GB1521
R1166 & R1167	1.5K ohm, ½w, 10% tol.	1521-E **	Allen Bradley EB1521
R1168	1K ohm, Trimpot	2100-0057	Beckman 72PMR1K
R1169	same as R1108		
R1170	same as R1102		
R1171	7.5 ohm, ½w, 5% tol.	$P55-E **	Allen Bradley EB75G5
R1172	110 ohm, ½w, 5% tol.	1115-E **	Allen Bradley EB1115
R1173	same as R1161		
R1146	10K, 1w, pot	2100-0093	AB 70A4N048S103U
R1148	20K ohm, 1w, pot	2100-0110	AB 70A4N048S203U
R1150	50K ohm, 1w, pot	2100-0125	AB 70A4N048S503U
R1152	same as R1150		
R1153	same as R1146		
R1156	1K ohm, 10 Turn Pot	2100-0059	Spectrol 534
R1157	500 ohm, 1w, pot	2100-0032	AB 704N048S501U
R1159	same as R1156		
R1160	same as R1157		
R1174	50 ohm, 1w, pot	9122-168 **	AB 70A4N048S500U
R1175	560 ohm, ½w, 5% tol.	5615-E **	Allen Bradley EB5615

* factory select

SWITCHES:

S1101	Rotary Switch, 3 pos. 4 wafer	8838 **	K. E. C.
S1102	DPDT, 254 AH	3101-0008	Arrow Hart 81023 CE
S1103	DPDT, 256 AH	3101-0011	Arrow Hart 21858X
S1104	DPDT, 254 AH	3101-0008	Arrow Hart 81023 CE

TRANSFORMERS :

T1101	Power Transformer	9105-0009	K. E. C.

SECTION 7

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